Le Monde de l'Agriculture Régénérative

From this...

Swale Mo

Counteracting Climate Change with Proven, Low-tech Solutions

Centered on Natural Water Cycles
Vegetation, Herbivores, Living Soils, Agriculture, and People

Sonaran Desert, Arizona

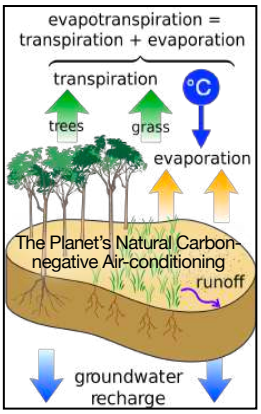
To this...

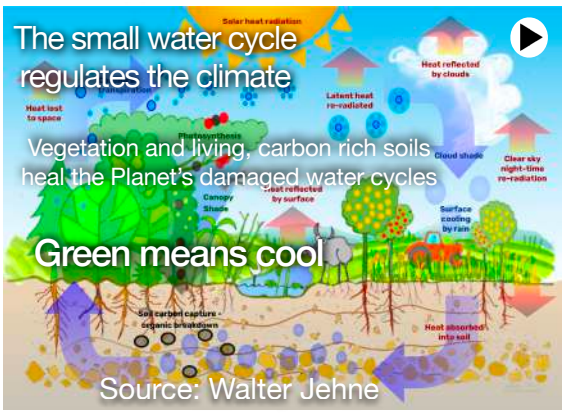
Both CAUSE and VICTIM, but also the source of the most powerful SOLUTIONS, AGRICULTURE is at the very core of our climate crisis.

Ulrich Schreier
Le Monde de l'Agriculture Régénérative
Mai 2021- updated July 2022

Elements to Fuel the Debate for a Climate-Smarter World

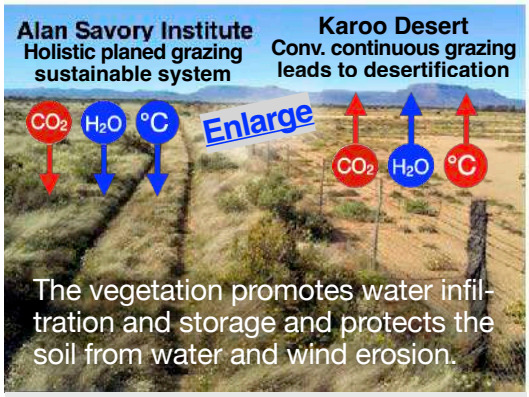
Vegetation is an excellent regulator of temperature, humidity, and climate. Everyone knows that in summer it is much hotter on city streets than in the countryside and a forest. Under the blazing sun, the bare ground dries out and degrades quickly, and temperatures on its surface can easily exceed 40, 50, or even 70 °C. These are conditions of desertification that

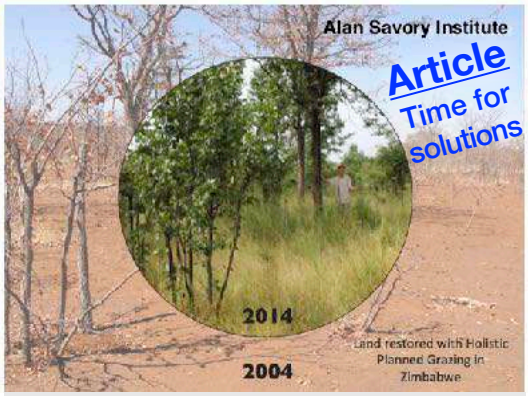




are fatal for a good portion of ***our microbial friends, the engine, and the very basis of living soils, agriculture, Nature, and Life on Earth.*** Thanks to shading and the cooling effect of ***EVAPOTRANSPIRATION, the plant's and the Planet's natural air-conditioning system,*** humidity is much higher and the temperature much lower under a green canopy. ***Evapotranspiration, a key link between the small water cycle and climate regulation, is powered by Sunshine and Photosynthesis, Earth's free, carbon-negative, life-enhancing, sustainable Power Source.***

Apart from the strict temperature and humidity effect, vegetation also has a regulating effect on atmospheric CO_2, soil life and bio-fertility, water cycles, bio-diversity, weather, and local climates. The reforestation, permaculture, and regenerative grazing projects in dry-land areas presented in this document are examples of what can be achieved in a very short time and with modest resources. They also show that working in harmony with natural processes has not only ecological but also considerable economic and social benefits.





South Africa Holistic management on the left has brought back biodiversity and natural fertility by regenerating the soil, greening the desert, restoring water cycles and cooling the climate.

Zimbawe : Thanks to regenerative grazing, the vegetation comes back to life, the climate becomes more balanced and some creeks start flowing again.

Pakistan: Planting one billion trees to regenerate a 3,500 km² area in 5 years! Has now been extended to 2028 and 10 billion trees.

India's Water Revolution : From Poverty to Permaculture

Born in 2016, it is already the biggest Permaculture venture on Earth! Its basis is **sound water management and the enthusiastic support of a highly motivated population**. Initiated by the Paani Fondation, it has ***changed, in just 4 years,*** the lives and prospects of some 4000 of Indias poorest villages!

Strong local support, reducing water loss thru runoff and keeping the rain falling during the Monsoon season inside the watershed, are the keys of the system. This is achieved through elaborate networks of harvesting, infiltration and storage of water, both underground and above ground, in order to cover the needs during the dry season.

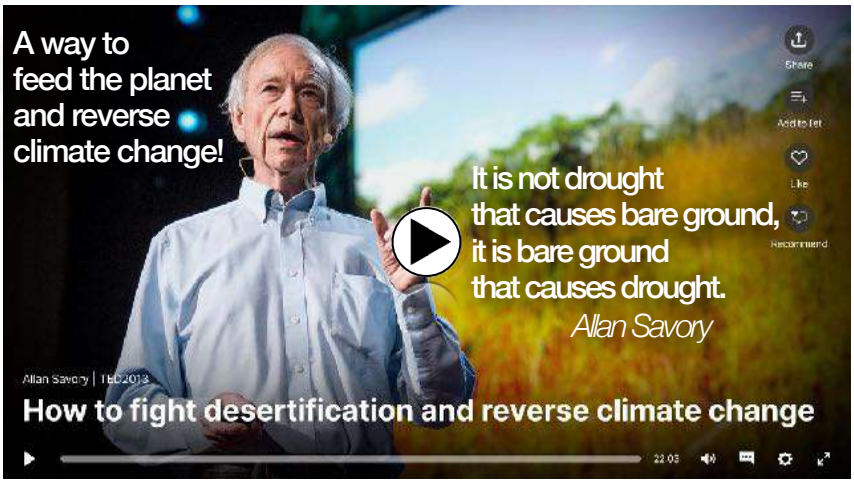
Andrew Millison's YouTube channel has 2 videos of this project (India's Water Revolution #1 and #2) and many others on permaculture projects in India and and other parts of the World.

Organic Farming in the South of India
ZERO BUDGET NATURAL FARMING (ZBNF)

When we look at the improvements in the many "Man-Nature Co-Creation Projects" presented here, we are astonished by the relative ease and speed of the recoveries.

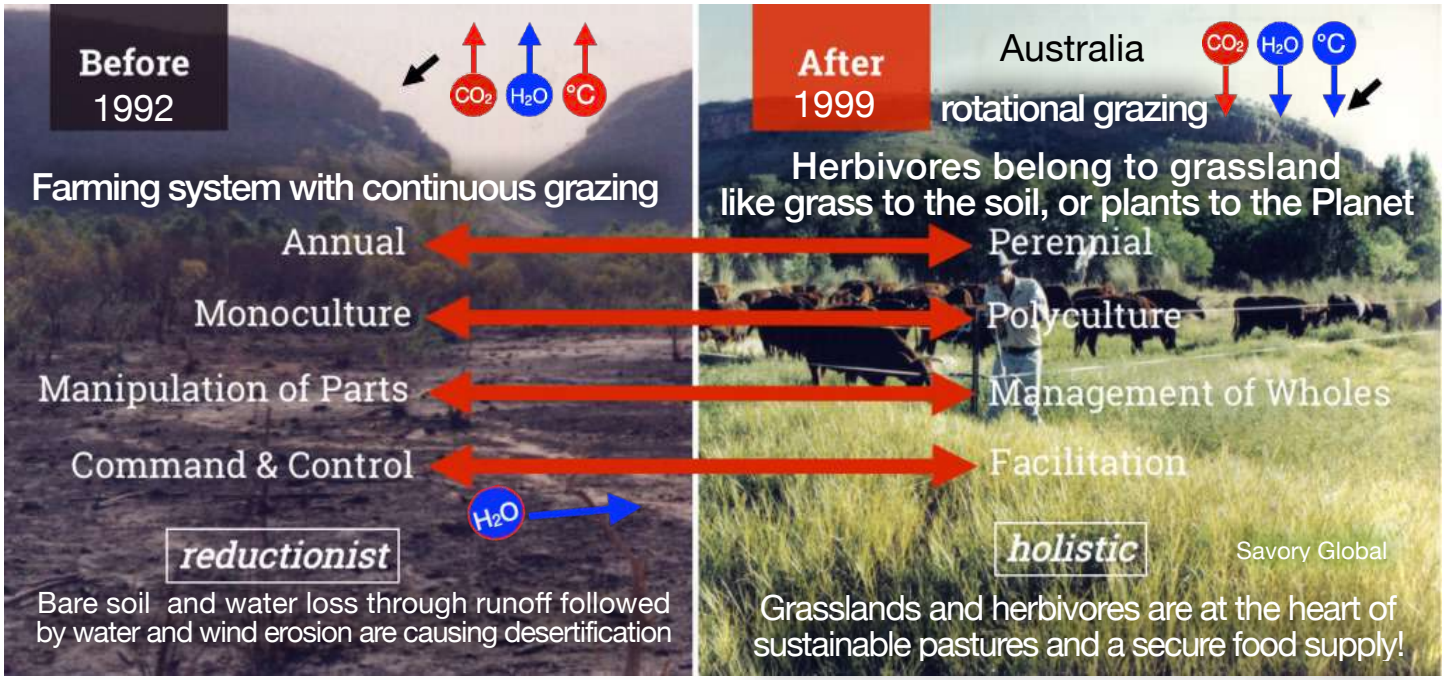
The situations shown in this document are based on the repair, the returning to wholeness, of damaged ecosystems through the restoration of green ground cover, biodiversity, water and weather cycles, and soil and plant functioning. Drawing on a wealth of data, knowledge, success stories, time-tested methods, and practical know-how, these initiatives have brought huge quantities of atmospheric carbon (CO_2) back into the soil, while producing ecological as well as economic and social benefits. All of this happened in a wide range of settings and in a surprisingly short time while getting by with relatively modest investments.

Both major ***causes*** and major ***victims*** of environmental degradation and climate change, humans and agriculture are also at the heart of the most effective, economical, and environmentally friendly ***SOLUTIONS***. According to Allan Savory, biologist, a pioneer in regenerating desertifying grasslands[1] and founder of the Savory Institute, ***agriculture in har-***



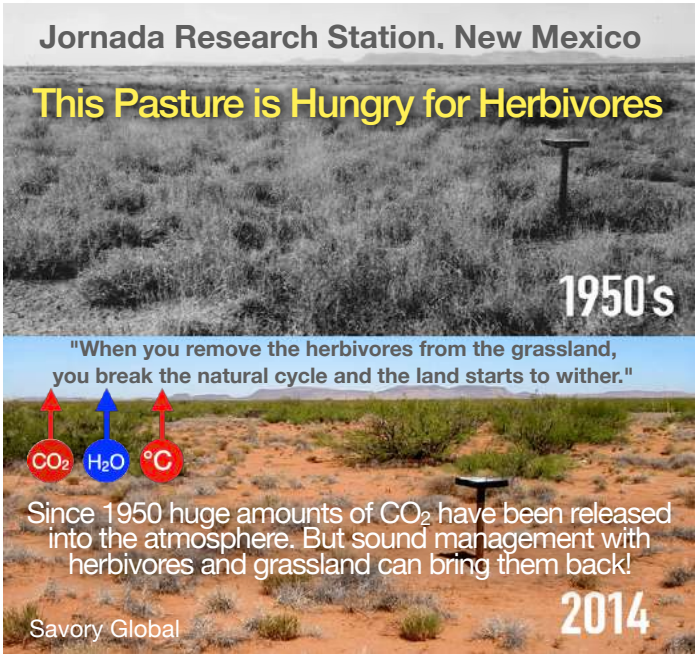
In 40 years Jadav Payeng, aka "Forest Man of India », has single-handedly transformed 550 hectares of desert land into a forest that brought back a vast flora and fauna (birds, elephants {115 on the 550 ha}, tigers, rhinos, deer, etc.)!

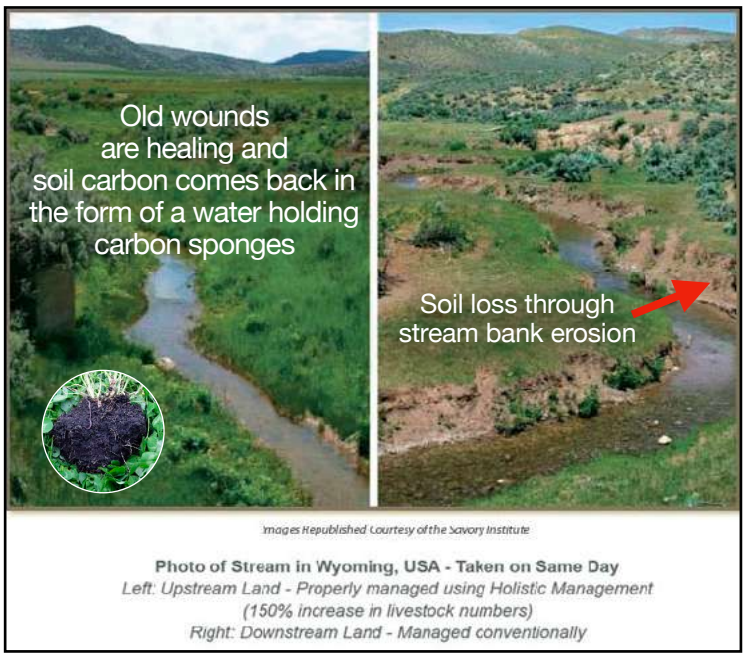
[1] In developing his holistic approach for regenerating grasslands by mimicking Nature using livestock, Alan Savory was strongly influenced by the work of the French chemist and agronomist André Voisin (1903-1964), known worldwide as the father of rotational grazing also referred to as regenerative or dynamic intensive grazing. Voisin is the the author of many publications and books on grazing, animal husbandry and health, the most notable being *Grass Productivity (1957)* and *Soil, Grass and Cancer (1959)*. Both have been widely translated and continue to be key references in the field.
Rotational grazing is not only sustainable, but also much more productive (higher stocking rates) than continuous grazing.



mony with natural processes is <u>our only option</u> for restoring water cycles, re-greening large desertifying areas, reversing global warming and fighting poverty, malnutrition, social and political unrest in many of the world's poorest regions[2].

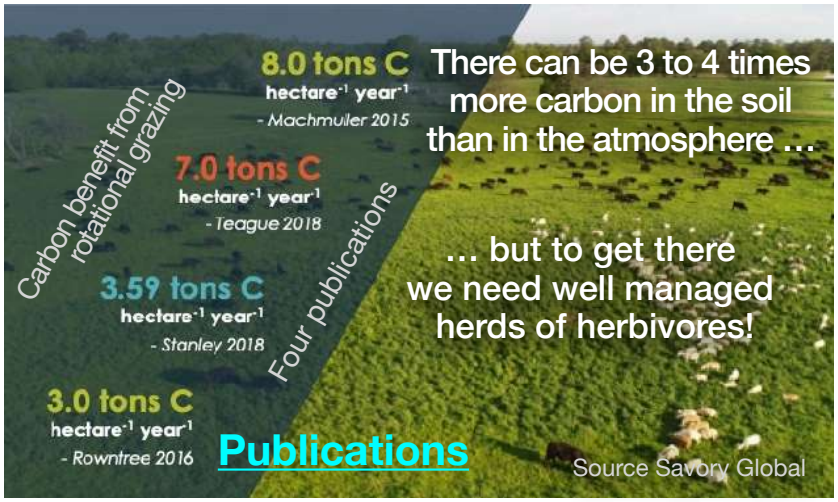
The Institute is on a mission to regenerate desertifying grasslands and the livelihoods of their inhabitants, through regenerative agriculture with properly managed pastures and livestock (holistic management). The institute has organized a worldwide movement of farmers and land managers whose hubs are present on all five continents. Also known as Savory Global, its network covers more than 13 million hectares, (130 000 km^2), over four times the size of Belgium, making major contributions toward grassland rehabilitation, biodiversity, and the restoration of local water and weather cycles. Their work has major impacts on mitigating and reversing global warming, carbon sequestration, and the production of healthy foods and drinking water. In addition, it produces a precious knowledge base as well as big economic and social rewards for farmers, ranchers, and local communities.



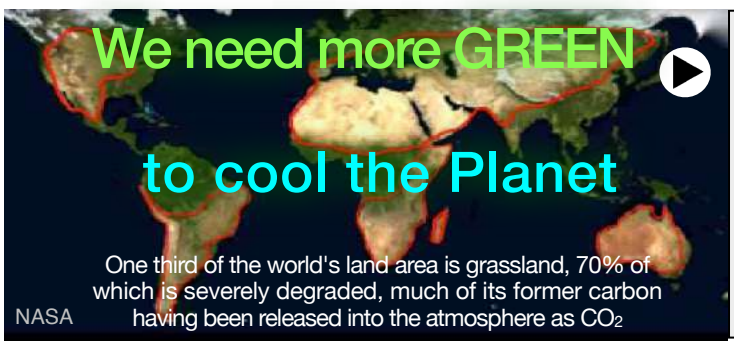


[2] Given the enormous inertia of our modern world and the difficulty of curbing greenhouse gas (GHG) emissions in the short run, even under the most optimistic scenarios, agriculture seems to be the only credible way to rapidly mitigate and reverse global warming, increase biodiversity, substantially increase green cover over large areas and economically and sustainably reduce CO_2 levels in the atmosphere!

The many successful examples from Savory Global, Brazil, India, China, Pakistan, and many other countries show that the restoration of Nature, soils, and water cycles does not require huge investments compared to some of the high-tech mega-projects that keep making most of the headlines. Using neither synthetic fertilizers, pesticides, nor the controversial techniques of geoengineering and GMOs, they employ hardly any fossil fuels or other scarce resources. Combined with properly managed livestock and crop production, they can provide large economic, ecological, and social benefits in just a few years, sometimes showing significant improvements as soon as the first season (see e.g. India's Water Revolution on page 3). A crucial source of soil fertility and food security, these low-tech solutions allow for an immediate start of thousands of decentralized and autonomous projects all around the Globe, without needing huge amounts of capital or complex organizational structures. Producing surprisingly fast and easily measurable results, they are affordable, low-tech, low-input, and low-energy, but high on people, economic, social, and environmental benefits.



Such prospects are a long shot from the highly technical and costly proposals focusing on CO_2 (e.g. CCS technology). Although still at an experimental stage and an uncertain future, these proposals are already dominating headlines in international climate conferences, scientific publications, and the media. Given the fact that the sun, plants, and photosynthesis are the Planet's all-in-one, carbon-absorbing, sustainable power source, and air conditioning system, **it appears doubtful that merely lowering atmospheric CO_2 levels with technological means, if at all economically feasible, would reverse global warming all by itself**[3].



Given the extent of deserts and desertifying areas located for the most part in the poorest regions of the Planet, the potential for restoring soils, vegetation and water cycles is enormous. Producing food and drinking water in quantity and quality, the deployment of ***EFFECTIVE SOLUTIONS*** is crucial not only in terms of climate change, but also from an ***economic, ecological and social*** perspective.

[3] A multitude of recent climate models and projections make the situation highly opaque and confusing. Based on mechanistic and linear reasoning, they are full of unknowns, contradictions and regularly changing assumptions,. We are far from the common sense and transparency of water based bio-inclusive climate models and the resulting greening solutions - Even if it were possible to bring down CO_2 levels with technology, it is doubtful that it would make a dent into Global Warming, let alone reverse it, without living soils, vegetation, herbivores and naturally functioning bio-systems.

The **success of the many re-greening projects** in desertifying dry land areas based on restoring water[4] cycles and damaged ecosystems, confirms the value of bio-inclusive climate models centered on water, living soils, vegetation, herbivores[5] , and agriculture.

Re-greening deserts is possible!

Lessons from the China Loess Plateau

John D Liu, cameraman and ecologist, has documented since 1995 **the greening of the Loess Plateau** in China as well as many other Greening Projects around the Planet showing simple, affordable, low-tech, solutions to restore heavily degraded ecosystems in a surprisingly short time.

Source: The Environmental Media Project & John D. Liu

The Loess Plateau through the glasses of Wikipedia

Loess Plateau Watershed Rehabilitation Project, China

Between 1994 and 2009 about 35,000 square kilometers, about 5% of the total area, have been restored.

"The lessons from the Loess Plateau show that it is possible to restore large scale damaged ecosystems and that this mitigates climate impacts, makes land more resilient and increases productivity."

- John D. Liu

This was the cradle and food basket of ancient Chinese civilizations - the Garden of Eden of the Orient.

Achievements: it took 2.5 million people out of poverty - Small dams reduce flooding and provide water to villagers - Reduced erosion and sediment flow to the Yellow River - **Beneficial effects on climate**. As in the case of "India's Water Revolution", **the key ingredients of this project are also sound water, agricultural and environmental management, combined with a strong community involvement!**

Update February 2021: **How Is China Turning Deserts Into Arable Lands?**

[4] **Water** is like CO_2 a greenhouse gas (GHG). Its atmospheric vapor concentration is about 25 000 ppmv or about 60x higher than CO_2 and has a 2 to 3x higher GHG effect. Regarding its physicochemical, biological and calorific behavior, it is one of the strangest substances there is. For a growing number of climatologists, **the biosphere and water in its many locations and forms** (snow, ice, liquid, vapor, haze, clouds, soil moisture, plant sap,…), and not GHGs**, are the dominant factors in climate regulation, CO_2 being to a large degree the result, a symptom, of massive and on-going soil and biosphere destruction.** In fact, they are the key, the basis, to getting us out of the climate dilemma.

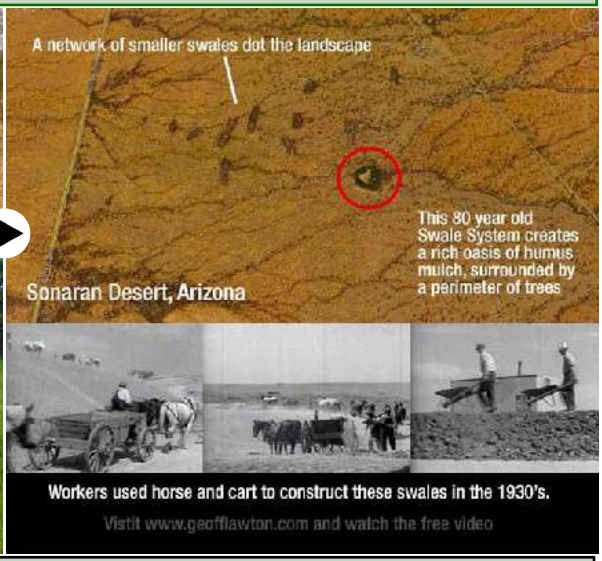
[5] Although it may be surprising that many restoration projects include livestock, let's not forget that **herbivores, especially cattle and huge grassland roaming buffalo herds, have been a key factor for the stability of grassland based bio-systems of which they are an integral part. In addition they are a precious source for food and soil fertility! It is important to realize, that the problem is not livestock in itself, but it's poor management by humans.**

Validating the pivotal role of agriculture and people in this vital process, these results are **ground for plenty of optimism** even when it comes to large-scale ***greening projects in some of the driest and most inhospitable places on Earth.*** With a highly favorable cost-benefit ratio and beneficial impact on the local climate and communities, these endeavors will be all the more effective if, at the same time, we reduce GHG emissions, over-exploitation of natural resources, waste, pollution, soil artificialisation, deforestation and degradation of agricultural land by over-grazing, deep plowing, bare ground, synthetic fertilizers, pesticides, antibiotics, and other destructive practices. The list is long, very long!

Greening some of the driest deserts on Earth

Geoff Lawton is with Bill Mollison one of the permaculture pioneers: **Discovering an Oasis in the American Desert**

Once man had primed the pump, Nature took care of the maintenance for 80 years, while the surrounding desert remained as dry and desolate as before!



The Al Baydha permaculture project in the Saudi Arabian desert - Video

Geoff Lawton : **From Desert to Oasis in 4 Years** **Jordania**

Harvesting rain : the rain that falls locally to "prime the pump" for building living soils, biodiversity, biomass and accumulate stable organic matter has been the basis for regenerating some of the driest, hottest and most desolate places on the Planet.

Greening the Desert in the Dead Sea Valley

Facebook page of the project

https://www.facebook.com/greeningthedesert2/

Restoring degraded forests in temperate zones

Over millennia, many natural forests in temperate zones have been decimated by over-logging, over-grazing and a lack of renewal. Restoration which needs humans as partners to plant trees and protect young growth from deer and livestock, has been started on a small scale in the 1990's with more projects launched since then.

This Man-Nature Partnership to restore the Caledonian forest was started by Alan Watson in 1989

Thousands of forests around the Globe are waiting their turn!

"Water governs over 95% of our **planet's** heat dynamics"

"The focus should be on water cycle restoration, not CO_2 emissions."

"Clouds are climate regulators: they cool the planet by reflecting incident sunlight out to space, preventing it from reaching the Earth's surface. By increasing the level, density and duration of cloud cover, we can cool the planet. But to do that, **we need green plants and organic matter in the soil to keep that whole hydrology working."**

"Climate change will persist until we heal the Planet's water cycles!"

Walter Jehne, Australian Soil microbiologist and Climate scientist

Virtuous feedback loops[6]: by stopping water loss through runoff and the gradual improvement of rainfall patterns, soil life and vegetation are generating a virtuous spiral which, as an additional benefit, will reduce CO_2 levels in the atmosphere by sequestering it in the soil as organic compounds, bio-fertility and a diversified community of living organisms, and above ground as vegetation and its dying residues. By its capacity to sequester large amounts of carbon[7], recycle water, and nutrients, and metabolize toxins, AGRICULTURE, by far humanity's most important economic and social endeavor, is at the heart of this virtuous loop. With a low energy footprint, to the extent it is guided by agro-ecological principles, it can do without all, or at least most chemical fertilizers and pesticides. Regenerative farming practices along these lines have a ***beneficial effect not only on climate and environment but also on crop health, weed pressure, plant resilience against pests, and climate hazards. In addition, they have a big impact on farm productivity, profitability, and sustainability, on food quality, safety, and security, on health, job creation, and the economic and social development of rural areas.***

For strong synergistic effects on water and climate cycles over wider areas and eventually at the planetary level, we need many more projects, millions of them, interacting with each other to form virtuous feedback loops.

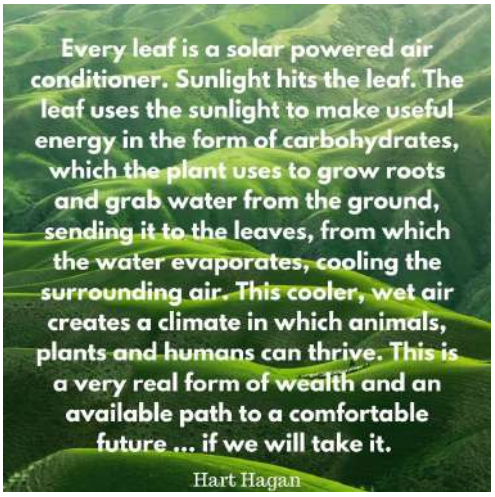
[6] **Walter Jehne**, an Australian Soil and Climate Scientist proposes a convincing **Climate Model**. By putting water cycles, spongy soil aggregates and vegetation in the center, he explains not only the **WHYs, the HOWs and rationales** behind the virtuous feedback loop, but, in proposing proven solutions, has **a very optimistic message for us. -** ***Climate Model***

[7] According to a **publication** by Dr. Rattan Lal, a world renowned soil scientist, the potential for CO_2 sequestration in the biosphere is estimated at 157 ppm over the next 80 years. ***This, by 2100, would bring CO_2 levels in the atmosphere back to pre-industrial levels of about 260 ppm.*** Judging from these estimates, ***the C storage capacity of the world's soils and biosphere is huge***. Unlike industrial feedlot and indoor livestock operations that emit large amounts of greenhouse gases (GHGs), holistic animal husbandry integrating crop production is not only sustainable but it is also more productive and has a favorable carbon balance - less carbon in the air, more in the biosphere (see White Oaks Pastures on page 16).

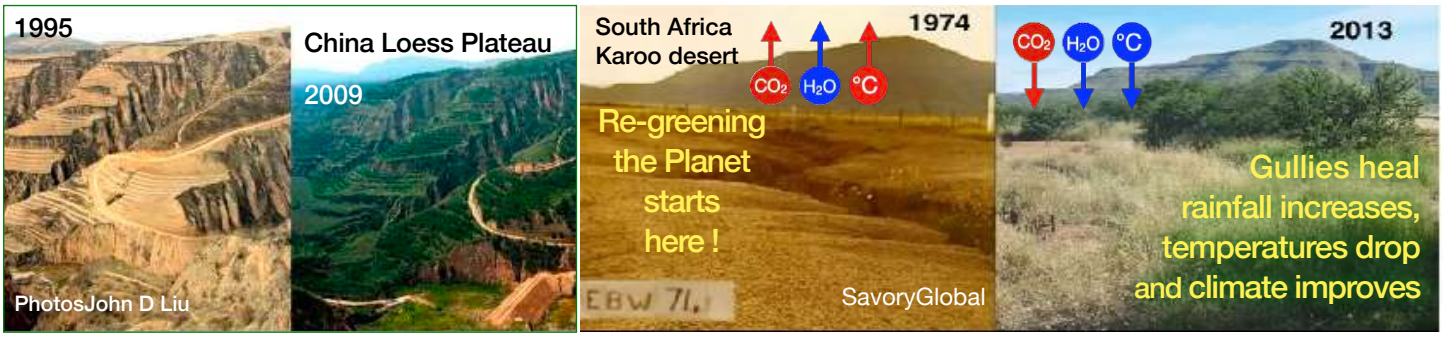
Started in 2007 but hampered by endless violence and wars, this crucial initiative to slow desertification and stop the Sahel from moving north, ***is of prime importance not only for Africa and Europe, but for the climate of the whole planet!*** - [FAO article]

The common threads in all of the successful initiatives highlighted in this document have been a passionate group of visionaries, competent pioneers, and leaders associated with the direct involvement and enthusiastic support of the various stakeholders, most of all the disadvantaged populations in poor areas who have seen rapid improvements in their livelihoods.

The particularly effective rehabilitation projects, both from a climate aspect and from the point of view of their economic, social and political impact, are the ones in poverty-stricken dryland regions of Africa, India, Pakistan, China, and Asian grasslands. Having accumulated precious know-how and sometimes enjoying organizational and financial support at the government level, most of these "Man-Nature Co-Creation Projects" could be scaled in a very short time and produce, within just a decade or two, major impacts on Global Warming, while reducing food and water scarcity, as well as healing many of the Blue Planets damaged landscapes and ecosystems.[8]



[8] To stop violence and wars, and establish peace and political stability in these regions, while slowing migration to big cities and industrialized countries, economic development, job creation, quality food and water in sufficient quantities are crucial! According to a growing number of scientists, consultants and practitioners, the best way to get there is in conjunction with regenerative practices such as permaculture, regenerative agriculture, tree-planting and well managed livestock. Animals have been precious friends and our traveling companions since the dawn of times. They have always played a key role in our lives and in agriculture, for the good and for the bad. For the good, as wild herds of herbivores and theirs predators roaming the grasslands or as well managed livestock. For the bad, if they are poorly managed by humans, a problem which unfortunately has been more often the rule than the exception and has accompanied the downfall of most past civilisations. The end phase was often uncontrolled grazing of sheep and goats which gave many eco-systems the final blow!



Partnering with Nature to reverse Global Warming by restoring water cycles and damaged ecosystems.

Reason for plenty of optimism: we know the causes and have the solutions to mitigate climate change and reverse global warming. By implementing thousands of greening ventures all around the Planet through soil and environmental restoration with the type of methodology described in this document, we can turn the tide within a few years. The many pioneering success stories show us that it can be done and also how we can do it. In some cases like the **Indian initiative *"From Poverty to Permaculture"*** with its "*Water Cup Competition*" and strong community involvement, the first significant benefits of this grassroots tsunami came as soon as the first season! Being a highly motivating enterprise, **ecosystem restoration will provide new optimism and meaningful jobs for millions of people, in particular youngsters looking for meaningful jobs.**

People and agriculture are the corner stone : Regenerative Agriculture, Permaculture and various other agro-ecological systems propose effective ***SOLUTIONS*** for restoring soil life, bio-diversity, humus (organic C), bio-fertility and hydrological cycles. By reducing, in most cases eliminating agrochemical inputs all together, these avenues open doors for moving rapidly towards productive and sustainable eco-systems without drowning in a jungle of weeds or suffering from poor yields and food shortages. **Being synergistic, crop production and animal husbandry should be integrated wherever possible to reach optimum soil regeneration, productivity and sustainability.**

What if the most destitute regions in the world and their impoverished populations were first in line to save our Planet from overheating? Given the size, location and diversity of these dryland areas, the majority being grasslands, their impact on climate change can be huge and very likely a determining factor, if not ***THE dominating factor***, for winning our race against global warming! Isn't that a compelling reason for the rich industrialized countries of the North to join and strongly support, financially and otherwise, the poor countries of the South? Such a cooperation wouldn't only change the climate, but has the potential to change the World.

We have the understanding, the knowledge, the know-how, the blue prints to follow, and the resources to repair in a short time, what took us and our ancestors several millennia to ruin.

Our toolbox is overflowing with proven solutions!

Bibliography

The problem of climate change is more complex than we think, but, as more and more re-greening initiatives are showing us, might be easier, faster and cheaper to solve than we imagine!

John D. Liu
https://knaw.academia.edu/JohnDLiu

Jean-Marc Jancovici
What is a climate model? What are the models' first conclusions? - models with CO2 as primary warming criteria.

Kravčík, Pokorný, Kohutiar, Kováč, Tóth
Kravčík & al-Water for the Recovery of the Climate - A New Water Paradigm

Machmuller 2015, Rowntree 2016, Stanley 2018, Teague 2018
Four publications on carbon sequestration

Markus Dotterweich
Dotterweich-The history of human-induced soil erosion

Rattan Lal
Rattan-Managing soils for negative feedback to climate change

Walter Jehne
profitable
Interview: Supporting the Soil Carbon Sponge
Video conference: Jehne-Climate Solutions for a Blue Planet
Restoring water cycles to naturally cool climates and reverse global warming

Ulrich Schreier
Articles on climat
Le Monde de l'Agriculture régénérative - Articles divers

Having made no progress in slowing **Global Warming** and reducing **Extreme Weather Events** by following CO_2, GHG, high-tech, mega-project, big-ticket based thinking, we urgently need

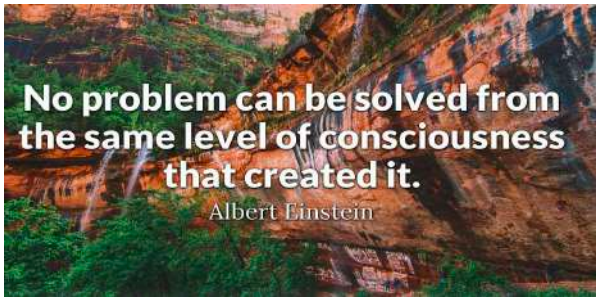
New Ideas, a New Vision!

A partial overview of organizations engaged in large-scale ecosystem restoration

- Bonn Challenge (350 Million Hectares by 2030): https://www.bonnchallenge.org/
- Brazilian Forest Restoration (Sebastiao & Leila Salgado): 2 million trees in 20 years
- Caledonian Forest restoration: https://alanwatsonfeatherstone.com/restoring-the-caledonian-forest/
- China Loess Plateau Restoration: 2016 publication by John Liu and Bradley Hiller.
- Commonland: https://www.commonland.com/
- Ecosystem Restoration Camps: https://ecosystemrestorationcamps.org/
- Forest Man of India: Jadav Payeng
- Great Green Wall of Africa: https://www.greatgreenwall.org/
- Mexican Initiative 20x20: Restoring 1 Million Hectares of Degraded Land
- Paani Foundation (India's Water Revolution): https://www.paanifoundation.in/
- Pakistan, Ten billion tree tsunami: http://tbttp.gov.pk/about-tbttp/
- Savory Institute, Facilitating the regeneration of Grasslands: https://savory.global/
- SEKEM - Sustainable Development since 1977: www.sekem.com
- UN Environment Programme (UNEP): The world's biggest ecosystem restoration project
- SER (Society for Ecological Restoration): Ecosystem Restoration Directory: https://www.ser-rrc.org/directory/

All really important innovations and changes normally start from tiny minorities of people who do use their creative freedom."

Ernst F. Schumacher
Economist and author of
"Small is Beautiful"
and Fonder of the *Appropriate Technology Movement*



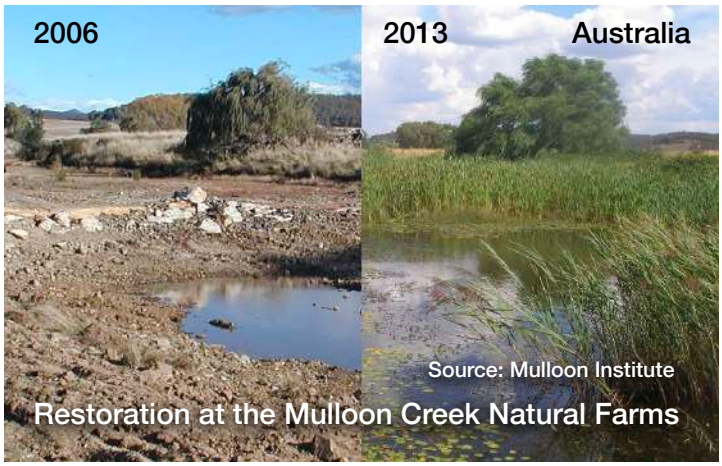
The problem of global warming is more complex than we think, but may be easier, faster and cheaper to solve than we imagine!

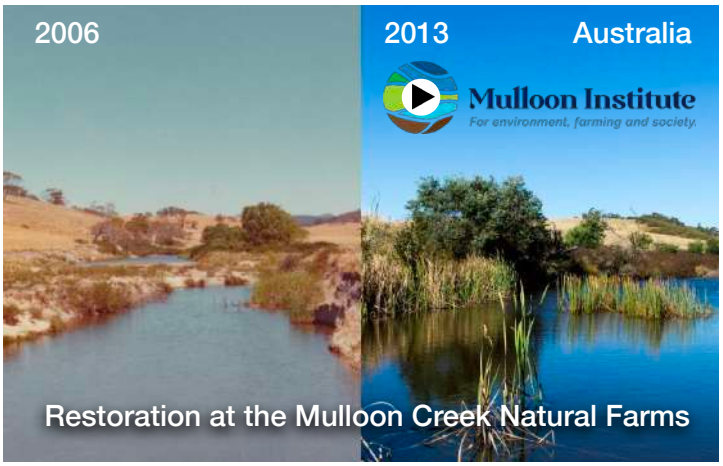
Mai 2021- updated November 2022

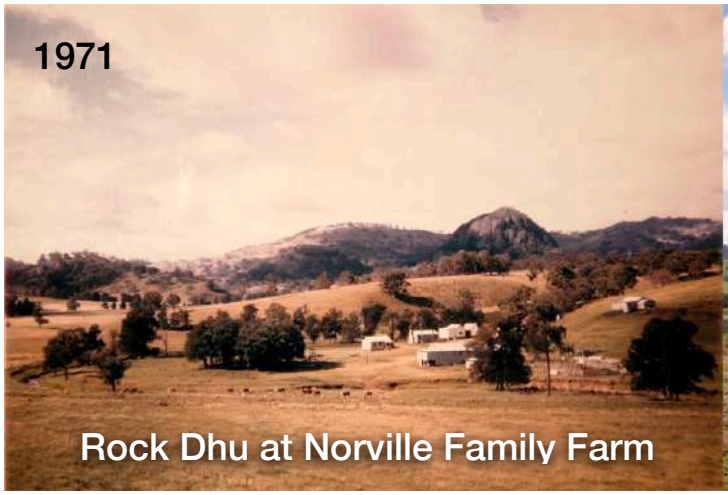
Ulrich Schreier F-49370 Vernoux

Appendix A - Projects that Restored the Land and the Climate

Photo sequence showing mangrove restoration at Palk Bay, India. (OMCAR Foundation)


2006
2013
Australia
Source: Mulloon Institute
Restoration at the Mulloon Creek Natural Farms


2006
2013
Australia
Mulloon Institute
For environment, farming and society
Restoration at the Mulloon Creek Natural Farms


1971
Rock Dhu at Norville Family Farm

2013
Australia

TALS INSTITUTE
Australia
2009

Yanet Creek Rehydration Project
2016

Australia
Winona – A case study in resilience
SoilsforLife
Garry Kadwell's Fairhalt
Case Studies
Salisbury: Rehabilitating the Scalds
Winona – Pasture Cropping the Way to Health
MULLOON CREEK
Mulloon Creek Catchment
'Dukes Plain'- Continuous Improvement of the Farm Resource
'Shannon Vale Station'- Weed control without herbicide is not a load of bull
Olsen's Hallora

Appendix B - Important Basics

What everybody knows about weather and climate

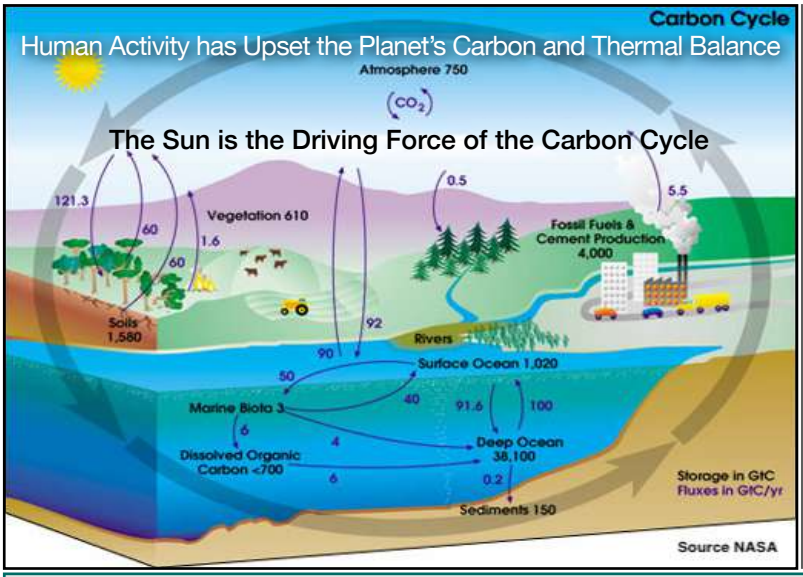
On a hot summer day it is much cooler in a lush forest than on concrete, treeless city streets.

And

- It is cooler after a thunderstorm than before.
- During the day a cloud cover keeps the mercury down.
- At night it is the opposite, it stays warmer under a cloud cover.
- The temperature difference between day and night is usually much larger during dry weather periods without cloud cover than during rainy periods with permanent cloud cover.
- In a cloudless desert where the humidity is very low, the temperature differences between day and night are huge.
- Bare soil is much hotter than soil under standing grass or trees.

These differences are explained by WATER and its natural cycles.

Both CAUSE and VICTIM, but also the source of the most POWERFUL SOLUTIONS, AGRICULTURE is at the very core of our climate and environmental crisis



$C_{sol} + C_{vég} \approx 4 \times C_{atm}$

In addition to the 1580 GT shown in this diagram, the soil also contains about 750 GT of C in various mineral forms, mostly as carbonates ($CaCO_3$, $MgCO_3$).

Vegetation and soil organic matter are the two expandable reservoirs that agriculture can rapidly enlarge to store excess CO_2, while waiting for the decrease of GHGs linked to fossil fuels.and industrial processes!

In addition to the severe carbon imbalance between biosphere and atmosphere, Planet Earth also suffers from a thermal imbalance. According to the International Panel on Climate Change (IPCC), our Globe receives on average 342 watts of solar radiation per square meter (W/m²). But because of human activity which has altered various ecological dynamics, in particular the Natural Water Cycles with its lower cloud related albedo effect, only 339 W/m² are being emitted back. *The differential of -3 W/m² or about -1% is what heats up the Planet.*

Facts that tell a climate story	Water (H_20)	CO_2
Atmospheric abundance in volume (ppmv)	~25000	~400 (ratio ~1:60)
Density at 25 °C (g/l)	0,8	1,9
Heat capacity of gas at 25 °C (cal/g)	0,5	0,2
Ratio of atmospheric heat content	~60	1
Phases in the range of -50 to +50 °C	Ice, Liquid, Gas, aerosol	Only gas phase
Phase changes are energy intensive (cal/g)	80 to melt, 540 liquid to gas	None
Green house effect (%)	~75	~25
Albedo cooling effect	High & crucial to temp control	None
Chemical reactivity	high (acido-basic, redox)	low (~inert)
Time in atmosphere (velocity-exchange)	8 to 10 days	100 to 300 years

Water dominates the Planet's heat dynamics and temperature control !

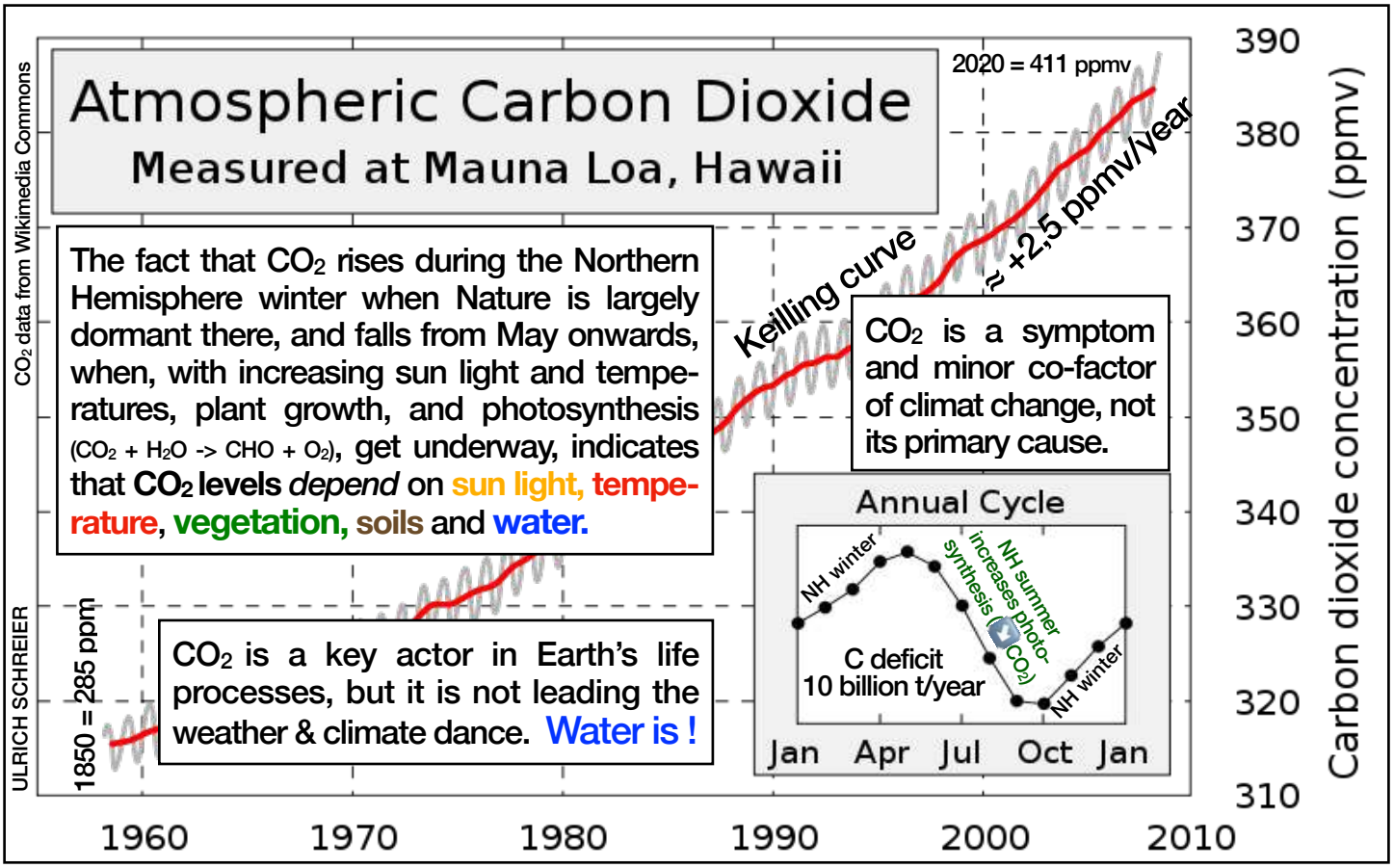
Much of their different abundance as well as the different dynamic and physicochemical behavior of water (H_2O) and CO_2in the atmosphere, the soil, oceans[9], freshwater reservoirs, and in life processes, point toward the water as the dominant factor in climate regulation. On average there are 60 times (up to ~120x) more water in the atmosphere than CO_2 (~25 000 versus 400 ppmv or 20 versus 0,8g/m3 with a respective specific heat of 2,1 versus 0,8 J/g). Multiplying weight (g) by specific heat (J) gives water a calorific edge of 65 to 1. Regarding the overall infrared greenhouse effect, water is again dominating by about 75 to 25%. The imbalance is even more lopsided concerning their average atmospheric residence time which is 8 to 10 days for the "liquid gold" versus 100 to 300 years for CO_2. When it comes to physicochemical properties and reactivity, the differences are again huge. Between -60 and +60 °C, CO_2 is a relatively inert, odorless, and colorless gas often dissolved in a liquid or a solid, in many instances water. Water on the other hand is the strangest and by far the most abundant substance on the surface of the Earth. Covering about 70% of the Blue Planet, it would form a 3000 m thick layer if it were spread out evenly over the entire globe. Always present where we find life, water is chemically highly reactive. It fills untold numbers of functions and takes on many different forms, some highly transparent with a blueish tint, others opaque: snow, ice, liquid, vapor, haze, clouds {Earth cooling albedo effect}, soil moisture, dew, plant sap, hydration layers, clusters, etc.).

This short comparison between these two crucial, inseparable, and in some respect polar substances for life on Earth, **points strongly toward water's dominant role when it comes to climate regulation.** Considering excessive CO_2 levels primarily as a symptom, even to a large extent the result of massive landscape destruction, **this reading sends us a very optimistic message and gives us many powerful levers to overcome Global Warming, endemic freshwater shortages, and extreme weather events** by repairing the Planet's damaged ecosystems and hydrology. This can be brought about through increased plant coverage, biomass production, soil life, humus levels (carbon and water-rich sponges), and bio-fertility, all of which have a positive and balancing effect on water cycles and Climate.

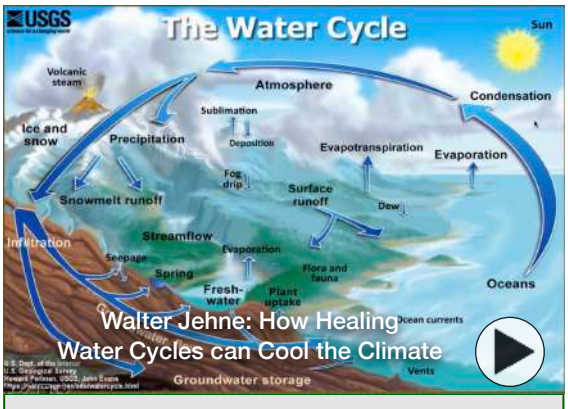
WATER CYCLES and AGRICULTURE, our prime levers for climate control

[9] Containing about 50 times more CO_2 than the atmosphere, oceans act as huge buffers for many parameters including temperature. This means that the effect of any remedial climate action will be much slower on the Planet's ocean parameters than on its water cycles and weather. Being constantly replenished from ocean reservoirs, atmospheric CO_2 might also come down very slowly which should have little effect on the climat.

Increasing the Planet's Vegetation Increases Biosphere and Soil Carbon, Lowering Atmospheric CO_2



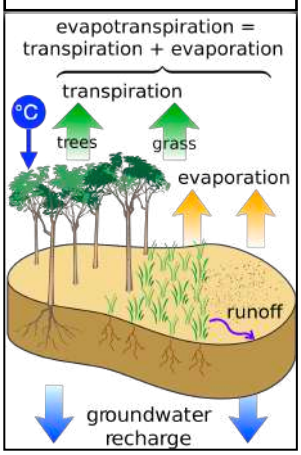
Walter Jehne's Climate Model in a Nutshell

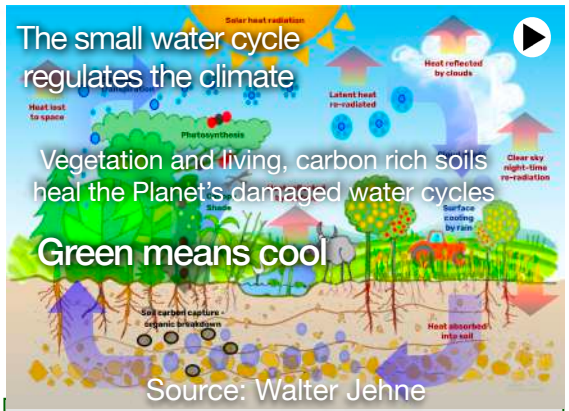


"Climate change will persist until we heal the Planet's water cycles!"

Walter Jehne

The Planet's natural and free air conditioning system





We have the science, the innovations, blueprints and the clear self interest to make this change.

What we don't have is time! - Action is urgent.

Walter Jehne and his Bio-inclusive ABCD climate model put water, spongy soil aggregates and vegetation in the center. Dealing with the multidimensional nature of climate, incorporating the biology, the chemistry and the physics, Jehne elucidates many phenomena that are difficult to explain: "why water and not CO_2 and GHGs is the key", "Asian brown haze with 4% moisture, 90% relative humidity plus pollutant smog", "diminishing of Earth's albedo which increases global warming", "high-pressure heat domes over bare, dry areas", "humid aridifyinig drought", the role of agriculture in eco-system destruction and desertification now and by our ancestors", or California's drought and fire crisis which, without appropriate action, may lead to desertification and the collapse of its huge agricultural complex.

Agriculture
Maximum plant growth for maximum carbohydrate production via sun, green plants and photosynthesis.
Biodiversity - 365 days/year

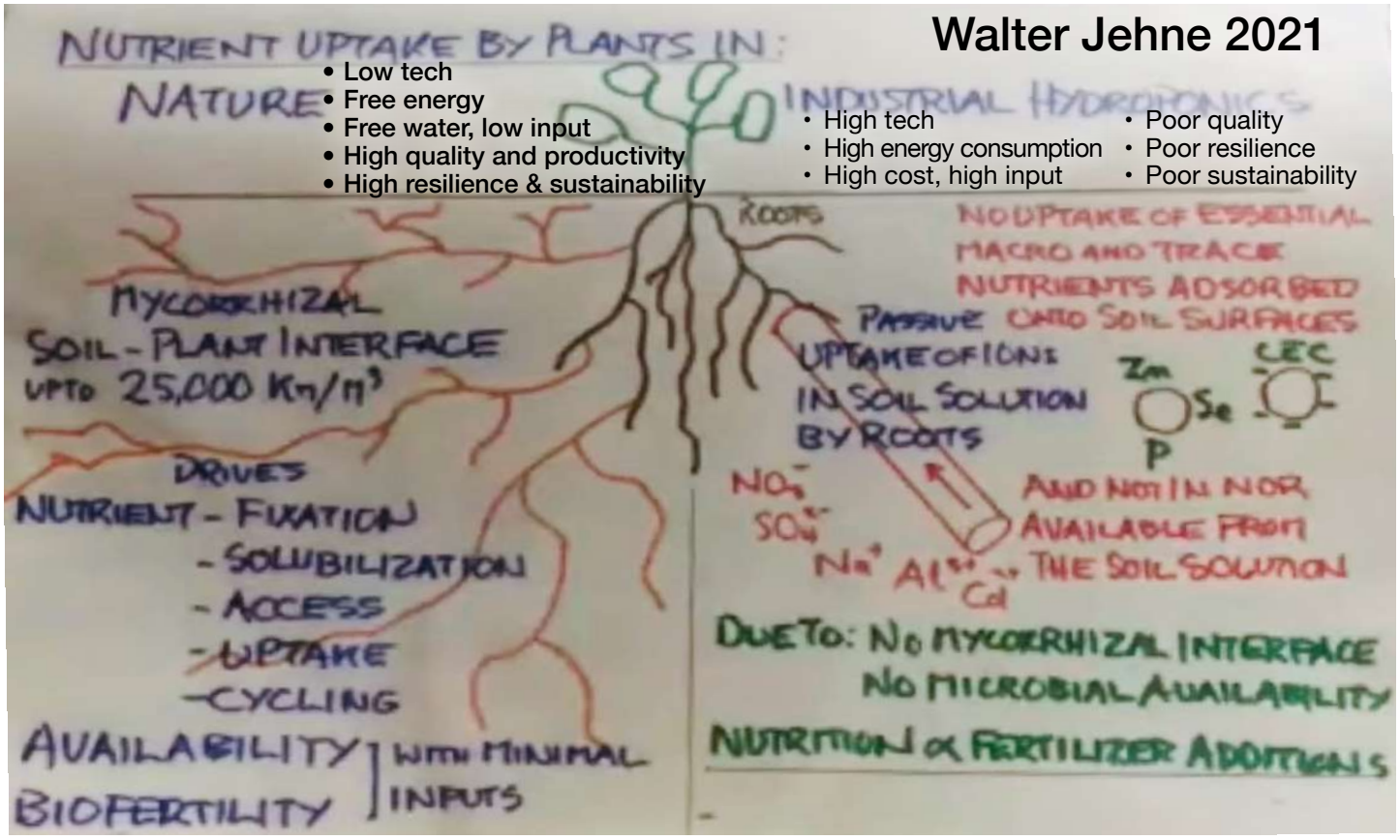
Burn by fire or oxidation:
-> CO_2 from slash and burn, cultivation, bare soils, fallow, compaction, irrigation, chemical fertilizers, pesticides.
-> Global Warming

Three of Jehne's statements:
"For the last 4 billion years the climate of the Blue Planet has been controlled by hydrological processes. ***Over 90% of the global heat dynamics and balance is governed by a range of water-based processes***."
"Restoring natural processes via the regeneration of our landscapes is now critical in order to **restore the former levels of high albedo clouds that naturally helped cool the planet.**"
"Water accounts for about 80%, CO_2 for 20% of the greenhouse effect,"

Dividends from the C sponge:
Water/nutrient availability
Microbial cycles, Root domin.
Pest/drought resistance,
Autonomy/very low input
Productivity resilience (+yields)

Carbon: *microbial digestion*
-> stable soil carbon sponges.
Raw materials: roots (40%), exudates (40%), litter (20%)
-> Humates and glomalin,
-> Regeneration

Feeding and ***keeping our "team" of soil microorganismes happy*** is the the basis. According to Jehne, we have all it takes for greening the Planet and reversing desertification and Global Warming: the understanding, the know-how, the ressources and the pioneers showing the way. The outcome is in our hands and depends on how we tilt the carbon balance in favor of **C** and away from **B**. This balance is very poor, and usually negative, with conventional farming, but can reach 60 to 70% of the produced biomass as stable soil carbon sponges, in regenerative systems with sound water, soil, biomass and microbial management. Jehne Climate Model



Increasing green-cover, and repairing natural water cycles, is conceptually simple and affordable…

Simple repairs…

- Conserve rainwater which falls to the ground to rebuild aquifers and stop accelerated run-off.
- Preserve surface water so it either *infiltrates soil*, or evaporates locally.
- Use greening to enhance water retention and lower air temperatures.
- Reduce erosion to increase the watershed's carrying capacity and save soil.
- Don't drain low-lying land, especially floodplains and mangroves.

… Affordable

- Scientists estimate that 0.1% of GDP p.a. over 10-15 years must be invested in water and soil conservation, plus revised agricultural practices.
- However, to be effective almost every country will need to participate: global weather stability returns only when adjacent small water cycles are repaired.
- **Poorer countries will require financial aid. Unless local peoples commit to the entire process, failure is the likely result: *Education is vital*.**

Source **Kravcik et al**

We are all in this together

PHOTOSYNTHESIS

The Planet's "Green Lung"

$6\,CO_2$ + $6\,H_2O$ + ENERGY → $C_6H_{12}O_6$ + $6O_2$

Carbon dioxide — Water — Sun light — Sugar (carbohydrates) our food — Oxygen

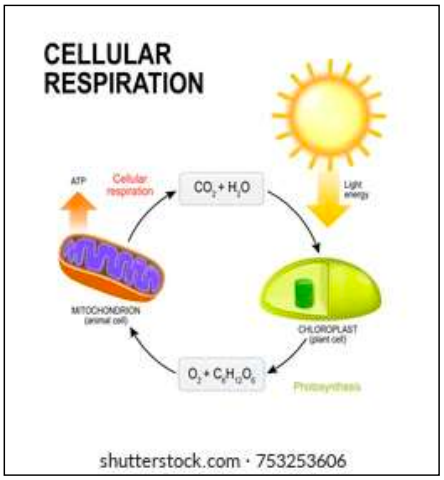
CELLULAR RESPIRATION

Our Lung & Metabolism

$C_6H_{12}O_6$ + $6O_2$ → $6\,CO_2$ + $6\,H_2O$ + ENERGY

Carbohydrates — Oxygen — Plant "food" — Water

These two processes are polar opposites and the basis of life on Earth



- Plants through photosynthesis produce our oxygen and our food

- Humans, animals and other oxygen breathing creatures produce plant "food" (CO_2)

The ☀ is the energy source for all life on Earth.

But there is no life without water !

Atmospheric composition

Nom du gaz	% présent
Diazote (N_2)- Nitrogen	78 %
Dioxygène (O_2)	21 %
Argon (Ar)	0,93 %
Water vapor (H_2O)	0 - 4 %
Gaz carbonique (CO_2)	0,033 %

The problem of climate change is more complex than we think, but, as more and more re-greening initiatives are showing, might be easier, faster and cheaper to solve than we imagine!

Grasslands are at the heart of the climate, agricultural and food sustainability!

SUN
The strongest force in our solar system, the sun creates plant growth through photosynthesis

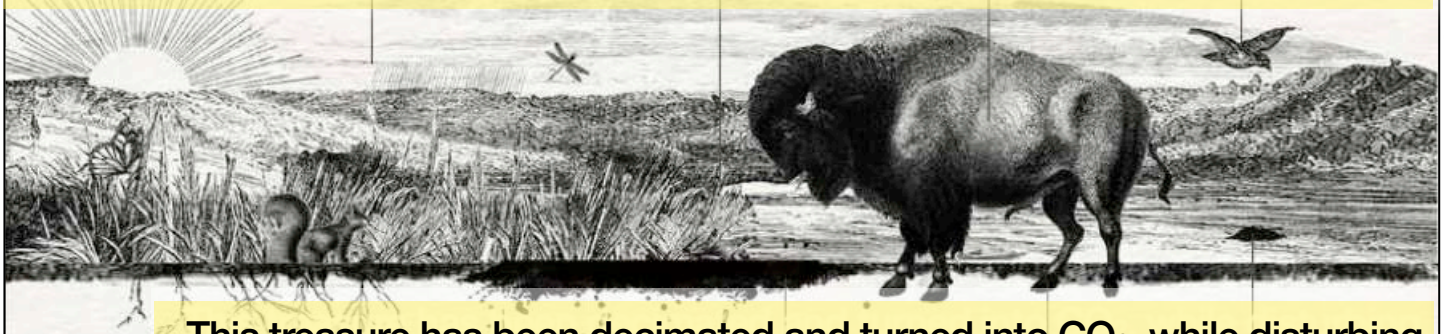
RAIN
Rainfall infiltrates soil and allows grass to grow. Thriving grasslands are effective at recharging aquifers.

PROPER GRAZING
Managed grazing stimulates further grass growth and root development

RUMINANT ANIMAL
Grass is digested in the rumen and converted to muscle

BIO DIVERSITY
Thriving grasslands provide habitat to thousands of living organisms

Herbivores belong to Grassland, like Grass to Soil Fertility and Plants to the Planet!



This treasure has been decimated and turned into CO_2, while disturbing Earth's water cycles, grasslands and climate!

THRIVING GRASSLANDS
Grasses capture CO2 from the atmosphere more effective than any other functioning earth system

GRASS ROOTS
Grass roots cycle carbon deep into the soil, thereby combating climate change

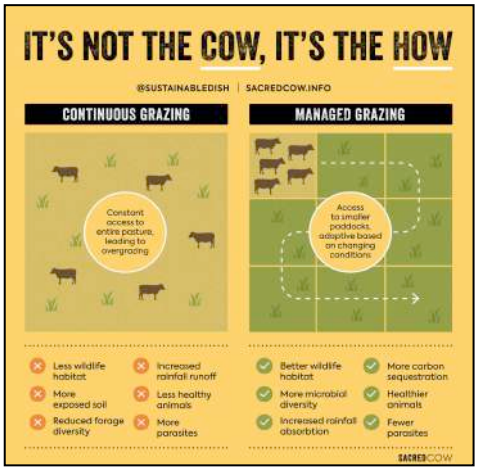
SOIL CARBON
in the ground- Soil carbon increases the pastures ability to hold water and feeds soil biology

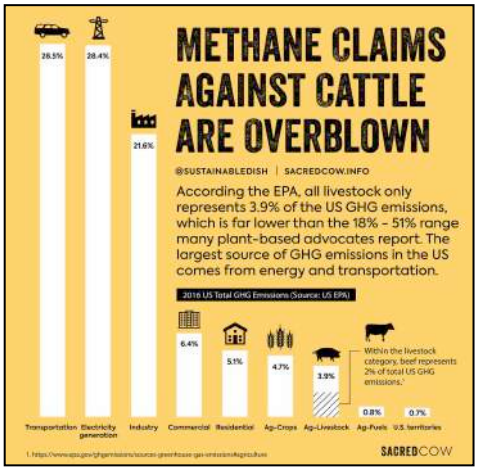
SOIL BIOLOGY
feeds plants and grasses while improving the nutritional value of food

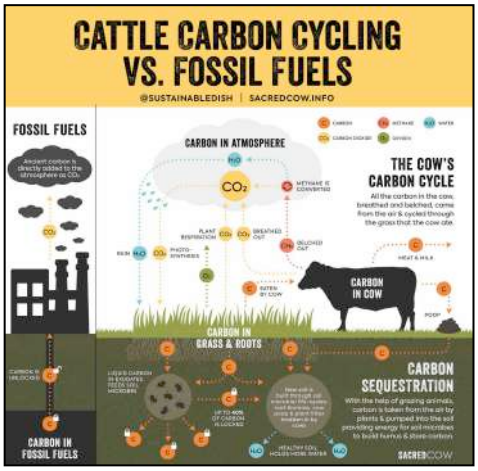
HOOVES
aerate soil, break up compacted earth, and improve circulation

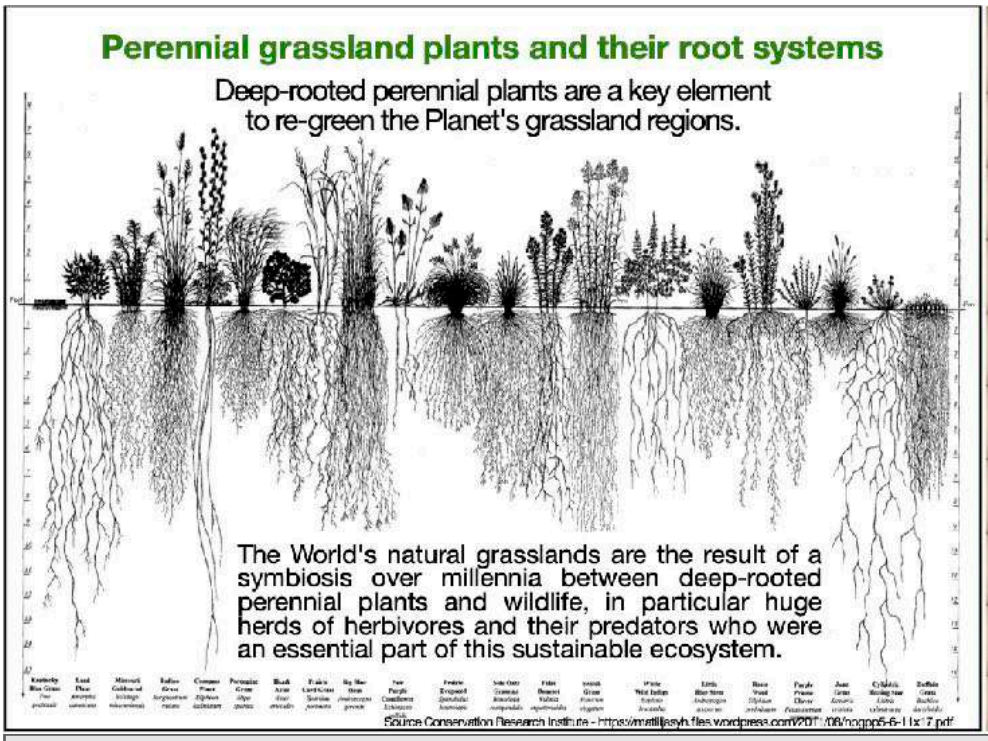
URINE AND MANURE
fertilizes soil through animal compost and feeds desirable biology

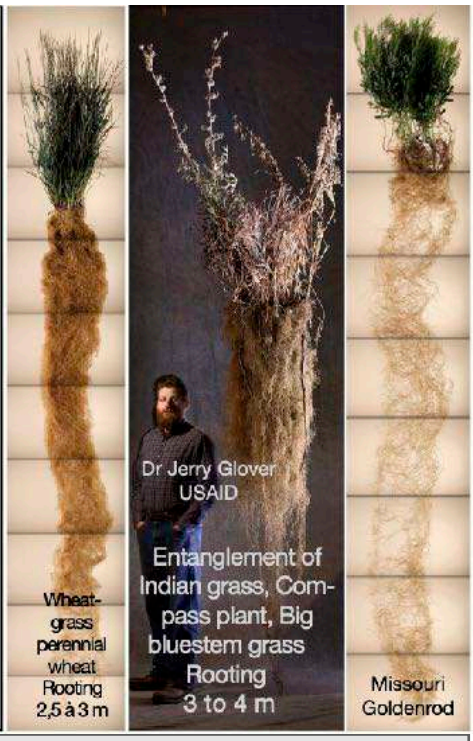
https://savory.global/resource-library/





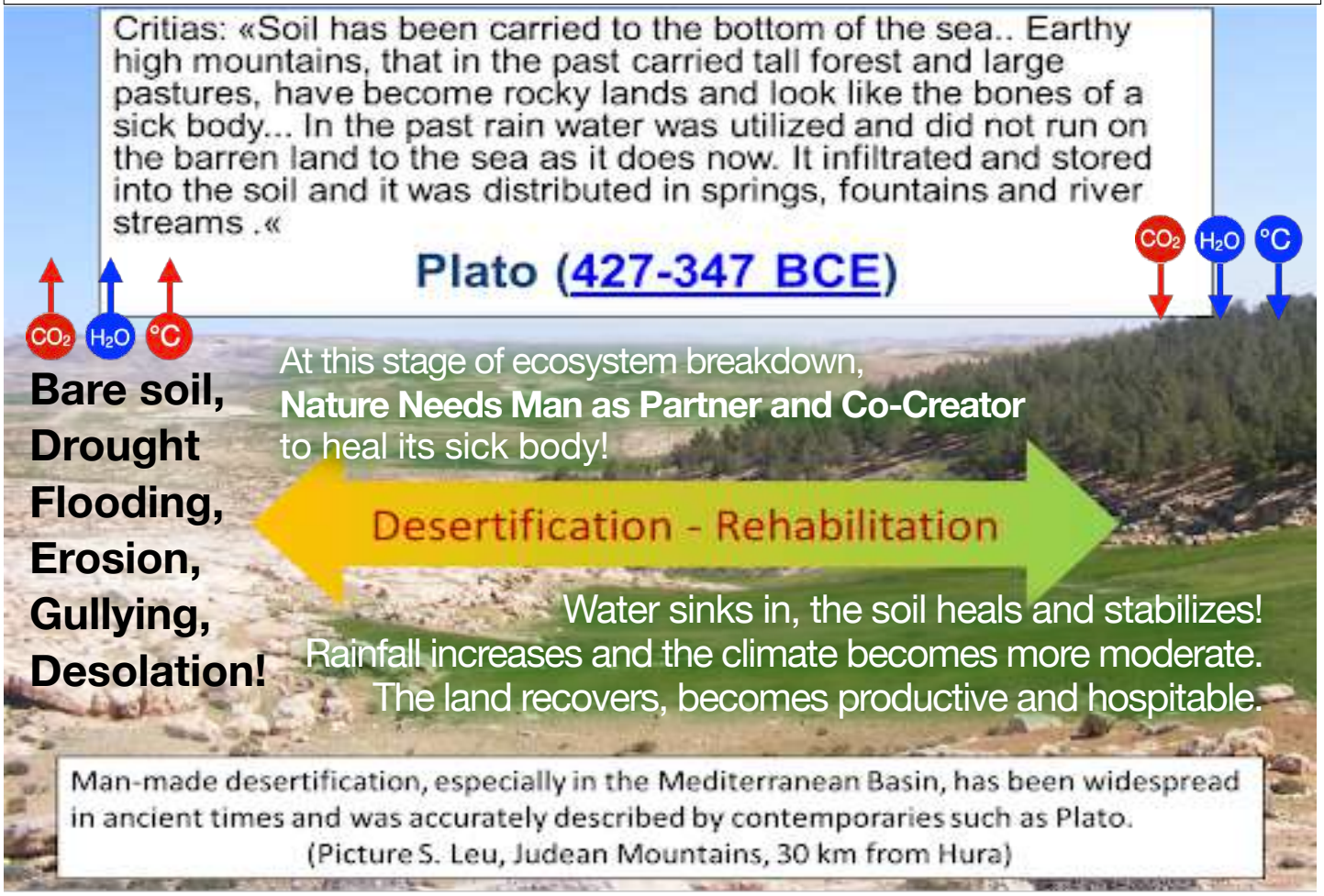






[Dr Glover's work with perennial plants] shows the importance of this treasure man has plundered and whose remains, in the form of CO_2, are now found in the atmosphere or, as an acidifier, in our oceans!

Appendix C
Historical perspective of soil and environmental degradation



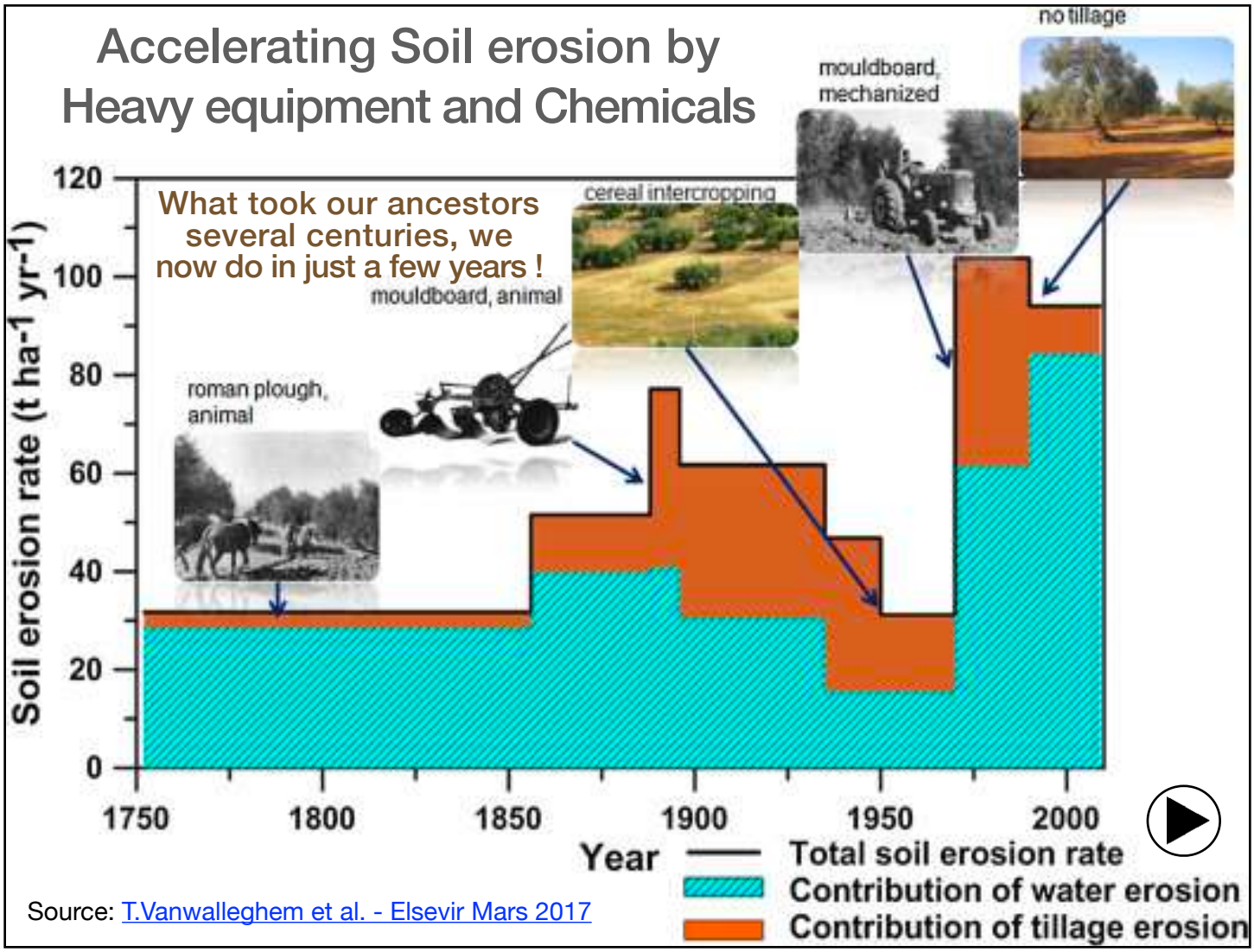
Soil and environmental destruction by man is not new and began at least 10 thousand years ago when our ancestors became sedentary and started to farm. In the past their main "weapons" were fire, axe, hoe and livestock, the first two mainly for preparing food, heating, clearing forests and producing raw materials for building houses and making various objects, the hoe, later joined by the plow, and livestock mainly for working the soil and producing food. Both deforestation and agriculture were practiced close to the settlements and only affected the surrounding environment. After the collapse of a civilization which, at the time, covered only a small part of the globe, Nature generally managed to erase its traces in areas with sufficient rainfall, whereas the wounds remained wide open in the more arid and more populated regions such as the Middle East (Mesopotamia with its proverbial Garden of Eden), around parts of the Mediterranean and the Huangtu Loess Plateau in China.

If soil and environmental destruction was more localized and took a few centuries or millennia in ancient times, it has become a global problem today and takes just a few years or decades, since many more of us are living on the Blue Planet and we now occupy large parts of its terrestrial landmass. Other factors that help explain the accelerated degradation of landscapes and the soaring amount of greenhouse gases (GHGs) released into the atmosphere are related to fossil fuels, polluting industries and means of transportation, rampant urbanism and sprawling infrastructures, waste, highly mechanized agricultural systems with oversized and overpowered equipment, intensive tillage, overgrazing, factory farms and feed lots, toxic side effects of synthetic fertilizers, pesticides, antibiotics, hormones, etc.

And the good news is: we know the WHYs and the HOWs of desertification, and we have **PROVEN SOLUTIONS** to stop and reverse it!

What happened to the Garden of Eden, the fertile crescent of the Middle East, the rich soils around the Mediterranean?

Causing sparse rainfall the missing plant and cloud cover contributes to local and global warming.



Source: T.Vanwalleghem et al. - Elsevir Mars 2017

Without appropriate action, California's Climate Change may lead to desertification and the collapse of it's huge agricultural complex (Walter Jehne)

Almost all farming-based cultures, from large civilizations to small peasant groups on little islands, have suffered from soil erosion. The erosion problems varied largely through time and space, and sometime extreme events have left a wide variety of imprints on the landscape over thousands of years. These are eroded hill-slopes and gullies, deposited sediments in sinks like lakes, foot-slopes, valleys, floodplains, river deltas and ocean floors. Many of them are of human origine and **the result of a lack of understanding, shortsightedness and poor land management.**

Markus Dotterweich has published an extensive study on this subject with over 400 scientific references in Geomorphology (2013), a peer reviewed scientific journal, under the title The history of human-induced soil erosion: Geomorphic legacies, early descriptions and research, and the development of soil conservation—A global synopsis.

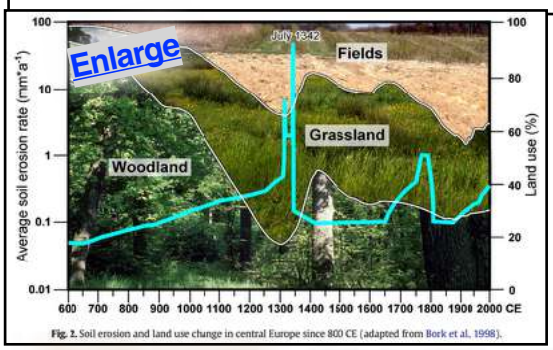


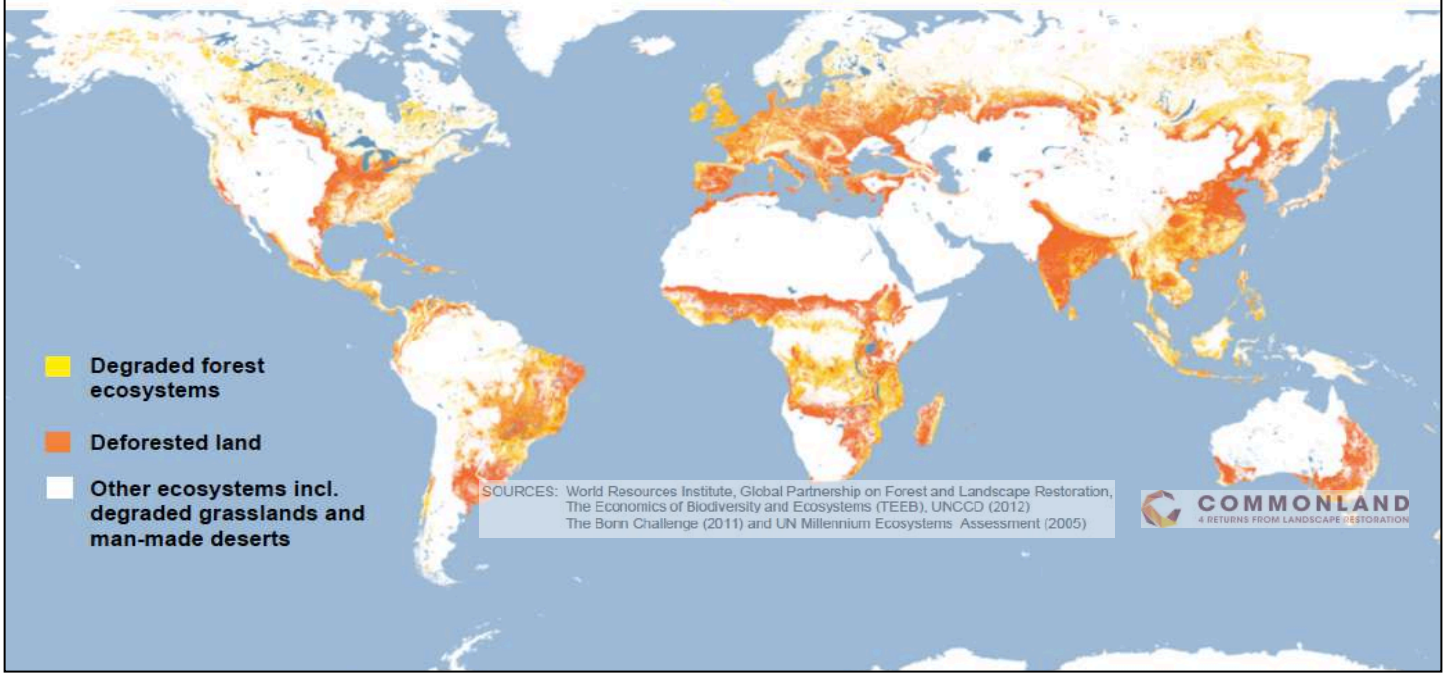
Fig. 2. Soil erosion and land use change in central Europe since 800 CE (adapted from Bork et al., 1998).

Since we know the causes and the solutions, why do we continue making the same mistakes ?

Overview of eco-systems degraded by human activity

15-23% of the land is degraded by human activity

- More land was converted to cropland in the 30 years after 1950 than between 1700 and 1850
- 2 billion ha = size of the USA & China
- Annual Economic = USD 21-71 trillion/yr (in 2012, the Gross World Product: appr. US$84.97 trillion
- Private Sector is not involved



Geographical Distribution of Drylands

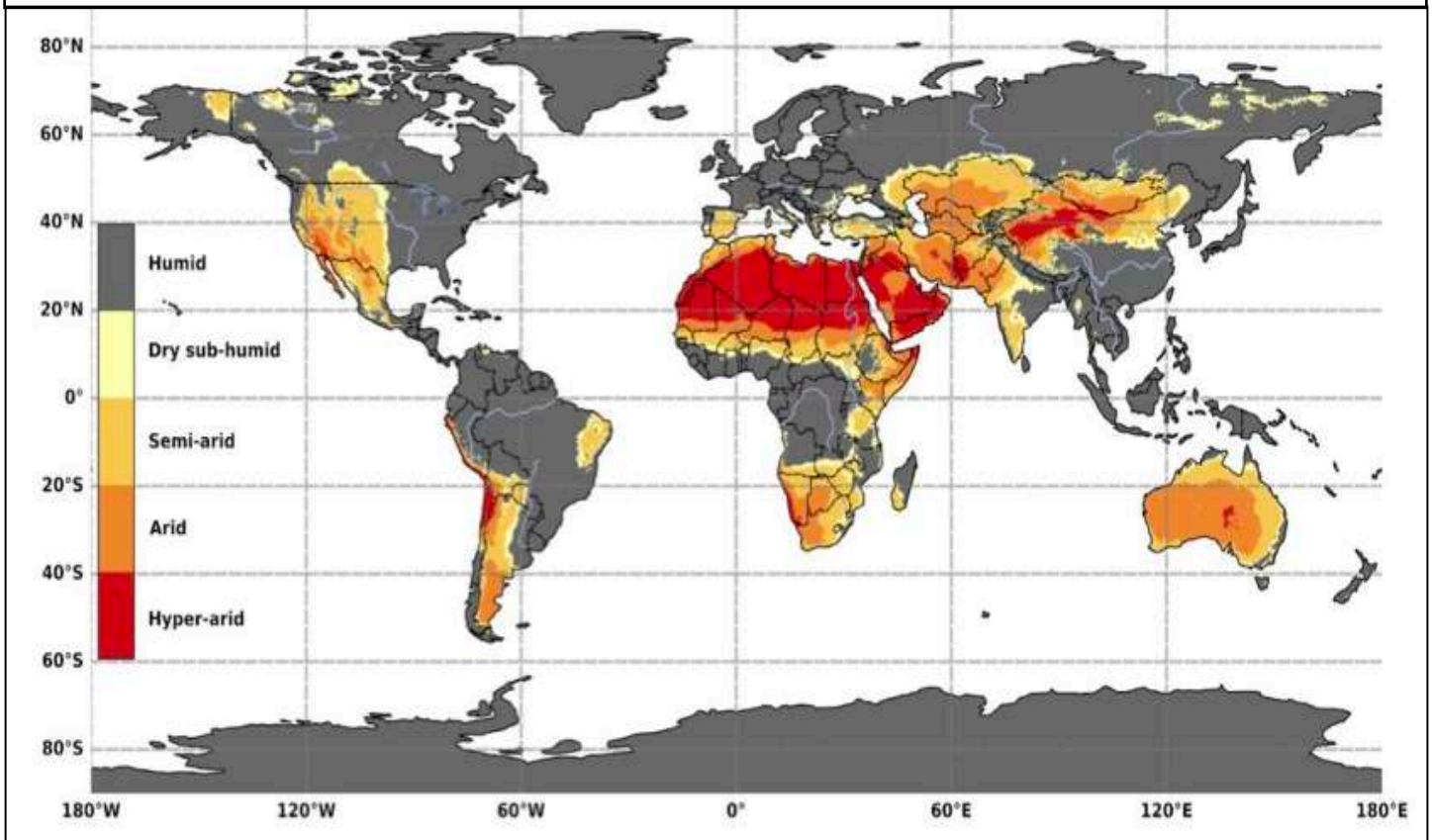


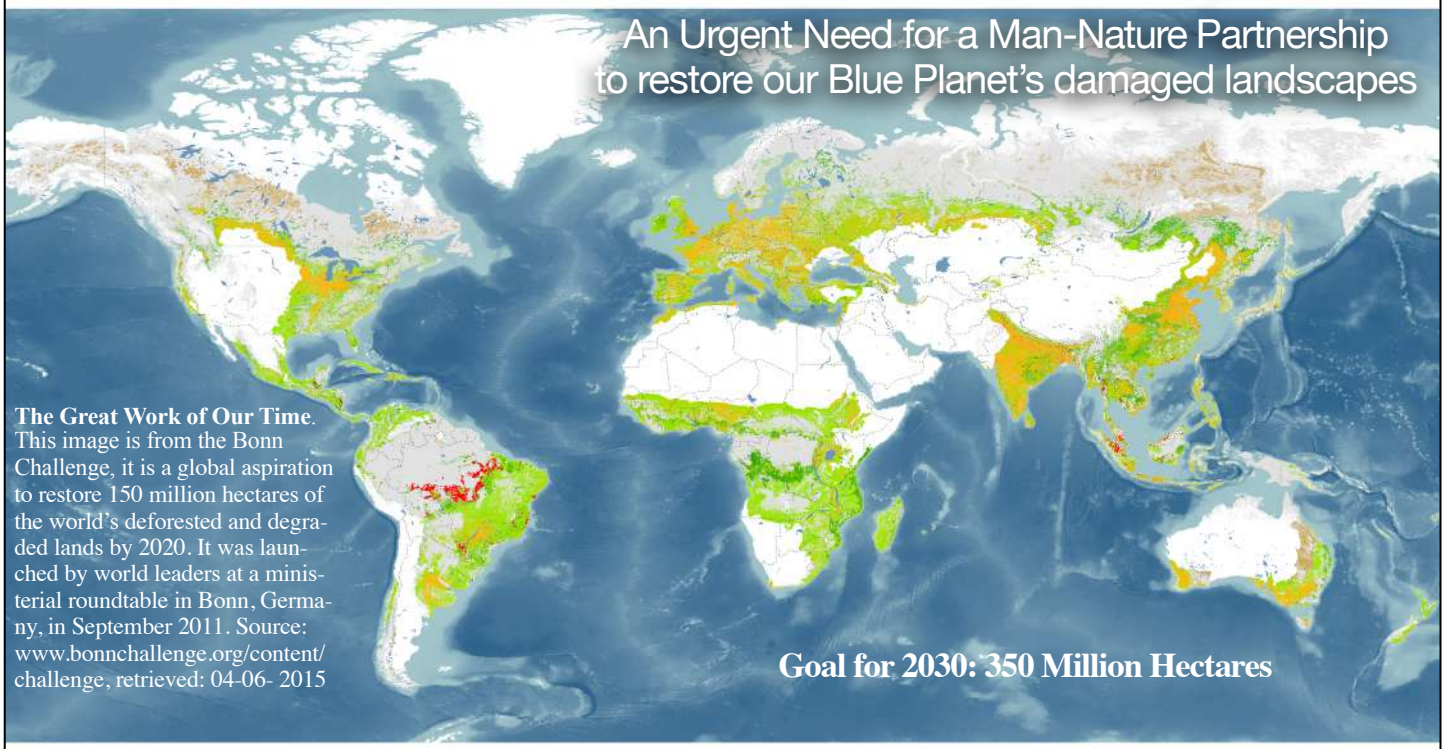
Figure 3.1 Geographical distribution of drylands, delimited based on the Aridity Index. The classification of the aridity index (AI) is: Humid AI>0.65, Dry sub-humid 0.50 < AI < 0.65, Semi-arid 0.20 < AI < 0.50, Arid 0.05 < AI < 0.20, Hyper-arid AI < 0.05. Data: TerraClimate precipitation and potential evapotranspiration (1980-2015) (Abatzoglou et al., 2018)

A World of Opportunity
for Forest and Landscape Restoration

October 2021
210 Million Hectares Pledged

BONN CHALLENGE
on forests, climate change and biodiversity 2011

An Urgent Need for a Man-Nature Partnership
to restore our Blue Planet's damaged landscapes



The Great Work of Our Time. This image is from the Bonn Challenge, it is a global aspiration to restore 150 million hectares of the world's deforested and degraded lands by 2020. It was launched by world leaders at a ministerial roundtable in Bonn, Germany, in September 2011. Source: www.bonnchallenge.org/content/challenge, retrieved: 04-06- 2015

FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES
- Wide-scale restoration
- Mosaic restoration
- Remote restoration

OTHER AREAS
- Agricultural lands
- Recent tropical deforestation
- Urban areas
- Forest without restoration needs

WORLD RESOURCES INSTITUTE · South Dakota State University · IUCN · PROFOR · Forestry Commission

The carbon sequestration capacity of fertile soils is enormous!

- Continuous grazing
- Chemical NPK fertilization
- Carbon sequestration < 20 tC/ha
- The loss of carbon is huge
- Poor water infiltration & retention

Soil regeneration

No spongy soil structure

20 m

Photos D. Chassot December 1995
Very dry summer in Australia

- Regenerative grazing
- No chemical fertilizers
- No pesticides
- Carbon sequestration > 100 tC/ha
- 100 t/ha ≈ 1 Gt/100,000 km2
- ≈ 3.3x the size of Belgium
- Good water infiltration and retention

Soil carbon sponge

Biodynamic pasture management with 500P

Vineyard soil - Rhone Delta, sandy clay loam (LAS)

Carbon sequestration and bio-fertility are 3D affairs

Photo Pierre Masson (2014)

Depth of 70 cm

70 cm

Soil Analysis

Organic reference plot

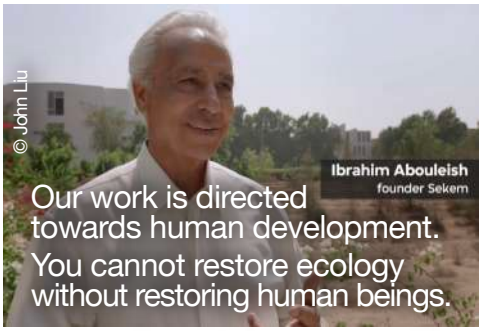
1 year Biodynamics

Appendix C - Sources of Inspiration

People and organizations healing damaged ecosystems

SEKEM, sustainable développement at its best

An Ecological, Cultural, Social, Economic and Agricultural Oasis in the Egyptian Desert



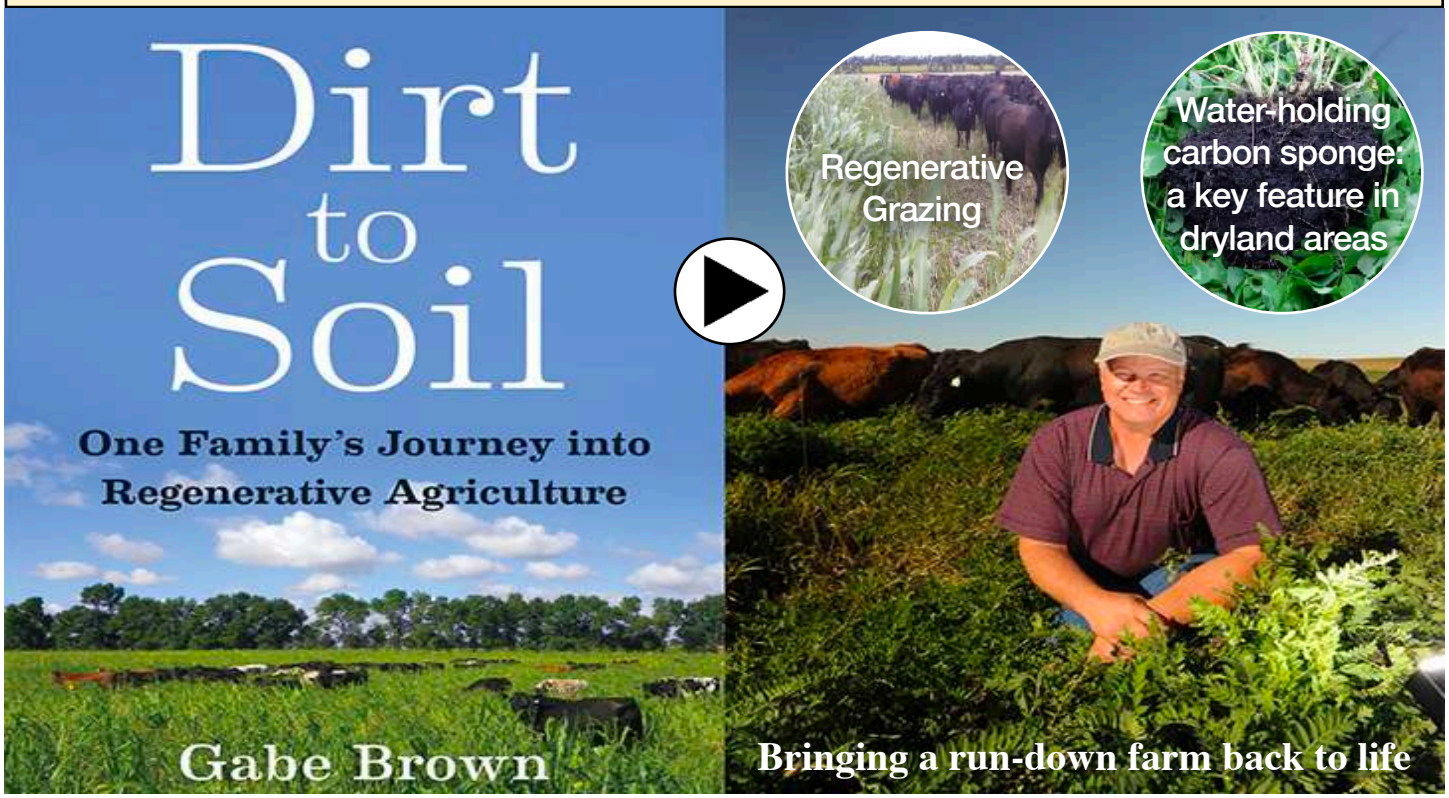
Having been started in 1977 on a 70 hectare stretch on the outskirts of Cairo in the midst of sand and desert by Ibrahim Abouleish (1937-2017), a Medical Doctor, Chemist and the recipient of the 2003 Alternative Nobel Prize, **SEKEM** is unique in its kind and unites ecological, cultural, social, economic and agricultural development. Its success story where ***biodynamic agriculture***, soil health and desert greening play important roles, is unique in the World. It now has over a thousand employees and, in cooperation with almost 300 subcontracting farmers, cultivates close to 1700 hectares. SEKEM's schools which started more than 30 years ago and since 2009 include *Heliopolis University for Sustainable Development,* have a total enrollment of over 3000 children and youth. https://www.facebook.com/sekemgroup

Brown's Ranch in North Dakota (http://brownsranch.us/)

Gabe Brown, a ND farmer, integrates regenerative grazing (mob grazing) with his crops in an area where annual rainfall is about 400 mm (16"). This highly productive and profitable system has allowed him to regenerate his soil at very low cost and to exceed the best grain yields of his neighbors.

Gabe Brown's Soil Health Principles

- **Limit disturbance:** Limit mechanical, chemical,
- and physical disturbance of soil.
- **Armour:** Keep soil covered at all times.
- **Diversity:** Maximum diversity of both plants and animal species.
- **Living roots:** Maintain living roots in the soil as long as possible throughout the years.
- **Integrate animals:** Nature does not function without animals



Polyface Farm in Virginia (https://www.polyfacefarms.com)

White Oak Pastures in Georgia

An initiative that has changed the lives of thousands of people and a whole region!

Vidéo* - *It's not the Cow, it's the How

The farmer's word: *Things that fascinated me when I was twenty were less fascinating at thirty, and were beginning to disgust me at forty.* (Will Harris)

White Oak Pastures, 1000 ha farm - a Savary Global's showcase (hub)
Shift in the mid-1990s from a conventional farming system to holistic management according to the principles developed by Allan Savory

Before 1995: conventional management
- **4 employees** at minimum wage
- **Conventional breeding:** cattle and pigs
- **Feed**: conventional cereal-based feed laced with antibiotics and hormones
- **Meat quality:** mediocre with pesticide, antibiotic and hormone residues
- **Economic situation:** precarious - end of the road
- **Social situation:** morose with a limited future in a poor and declining area of Georgia

Unsustainable

After 20 years of holistic organic management
- **165 well-paid employees**
- **Diversified breeding:** cattle, pigs, sheep, chickens, laying hens, turkeys, geese, ducks, rabbits...
- **Feeding** : mainly via rotating pastures
- **Vegetable crops** - biodiversity and soil carbon have soared!
- **Slaughterhouse and food processing on site**
- **Product quality:** excellent, wide choice
- **Economic situation:** excellent - model for the future
- **Social situation:** very positive, innovative company reviving a village (Bluffton) and a whole area of

Chèvrerie and Cow - la Petite Brosse, a diversified French farm

TECHNIQUE **Stratégie**

200 allaitantes et 150 chèvres en **système tout herbe**

À la Chèvrerie and Cow, dans le Loiret, chèvres et vaches tournent en pâturage dynamique sur quelque 180 ha clôturés par près de 90 km de barrières.

LE CONTEXTE

➲ **À Girolles, dans le Loiret,** Jean-Baptiste et Stéphanie Drouin ont créé la Chèvrerie and Cow. Ils conduisent 200 black aberdeen-angus et 150 chèvres alpines, et se lancent cette année dans la production d'une soixantaine de porcs par an. Les trois ateliers sont en bio.

➲ L'exploitation accueille deux fois par semaine les clients dans un **magasin à la ferme.**

➲ 180 ha, jusqu'alors cultivés, ont été implantés en herbe et divisés en paddocks pour un **pâturage tournant dynamique.**

180 ha divisés en trois

100 chèvres 5 ha de pâture et 15 ha de luzerne en trois coupes.

200 angus 100 ha de pâture et 50 ha de pâture fauchée, dont 20 ha en luzerne.

30 cochons 2 ha en rotation.

De l'herbe, de la luzerne, et c'est tout. C'est ainsi que Jean-Baptiste Drouin et son épouse Stéphanie, éleveurs à Girolles, dans le Loiret, nourrissent 200 blacks aberdeen-angus et 150 chèvres alpines.

Ce système tout herbe, ils ont dû le recréer de toutes pièces. Quand ils se sont installés, il y a une dizaine d'années, sur l'exploitation du père de Jean-Baptiste, en pleine région céréalière, ils ont compris en revu l'assolement. « Sur ces 180 ha regroupés autour de la ferme, tout était cultivé, se souvient Jean-Baptiste. Il n'y avait plus d'animaux. Mon père faisait des céréales, du maïs irrigué, mais ça n'était pas notre credo. »

Dans un premier temps, ils constituent un troupeau d'une soixantaine de chèvres, avec transformation et vente à la ferme. Ainsi naît la Chèvrerie de la petite Brosse, qui deviendra la Chèvrerie and Cow avec l'arrivée du cheptel allaitant. Petit à petit, toutes les parcelles sont retournées et implantées en prairie ou en luzerne. Ces surfaces sont aussi en partie plantées d'arbres fruitiers. « Il nous a fallu plus de deux ans pour poser 90 km de clôtures », lance Jean-Baptiste.

Côté matériel, il ne regrette rien. « Nous avions une moissonneuse-batteuse et cinq tracteurs, se souvient-il. Aujourd'hui, il n'en reste qu'un, et nous l'utilisons à peine 200 h/an. Même pour déplacer les bovins, nous n'attelons plus la bétaillère. Nous les emmenons à cheval. Cela limite le stress des animaux. »

Les 17 hales plus proches de la ferme sont réservés aux chèvres. Elles sortent 3 h/jour, de mars à octobre, en pâturage tournant. « Il y a sept paddocks en tout, calcule Jean-Baptiste. Les chèvres laissent souvent des refus lorsqu'elles quittent une parcelle, j'y mets ensuite les chevaux. Eux nettoient tout. »

« 24 heures par paddock »

Même système de pâturage tournant dynamique pour les angus, qui vivent exclusivement dehors. « Le troupeau, de 80 mères et leurs suites, tourne sur 150 ha, dont 100 sont divisés en petites parcelles, compte Jean-Baptiste. Nous avons tout clôturé, de sorte d'avoir des paddocks de 1 ha en moyenne, sur lesquels chaque lot ne reste pas plus de 24 h. » Dès que les mères et leurs veaux entendent le 4 x 4 de l'éleveur s'approcher du pré, tous lèvent le mufle pour se précipiter vers la sortie du champ. Jean-Baptiste ouvre le paddock voisin, et envoie son chien, un berger australien, derrière le troupeau. Les bovins ne se font pas prier, s'engouffrent dans la nouvelle pâture et plongent la tête dans l'herbe fraîche. « Voilà comment, en moins de trente secondes, je nourris tout un lot d'animaux », sourit-il. L'hiver, lorsque les sols sont moins portants, les animaux disposent d'une parcelle protégée par un bois. « Mais nous envisageons d'aménager un ancien bâtiment en stabulation, pour les deux mois les plus rudes. »

Les vêlages sont groupés sur la sortie d'hiver et le début du printemps. Les vaches bénéficient ainsi d'une herbe abondante pour soutenir leur production laitière, et les éleveurs ne sont pas dépassés par la pousse. Les jeunes sont sevrés en fin d'année et allotés par sexe. « Nous gardons les mâles entiers pour la vente directe et un restaurateur, décrit Jean-Baptiste. Nous en abattons un par semaine. » Les animaux sont âgés de 2 à 3 ans, et affichent en moyenne un poids de carcasse de 340 kg. « Ils partent à l'abattoir de Cosne-sur-Loire (Nièvre), puis c'est un boucher qui s'occupe de la transformation, ajoute-t-il. Nous proposons des colis, de la viande au détail et des plats préparés de type pot-au-feu. »

« Pas besoin des génisses »

Pour l'instant, aucune jeune femelle n'est conservée. « Elles sont toutes vendues pour la reproduction, explique-t-il. Nous n'en avons pas encore besoin pour le renouvellement. La longévité de l'angus est telle qu'une vache peut avoir 12 à 15 veaux ! Et il existe une forte demande en France pour ce type de génisses. Sans compter la trésorerie qu'elles représentent pour la ferme. »

Cet hiver, la Chèvrerie and Cow a lancé un troisième atelier : du porc en plein air. « Un petit bâtiment servait à ranger le matériel pour les cultures, précise Jean-Baptiste. J'y ai construit des cases sur pailles pour les cochons. Dehors, ils disposent de 2 ha divisés en paddocks. » Avec seulement trois truies, Jean-Baptiste espère produire une soixantaine de porcelets par an. « Cela représente un animal à abattre par semaine, calcule-t-il. C'est tout ce dont j'ai besoin pour le magasin. »

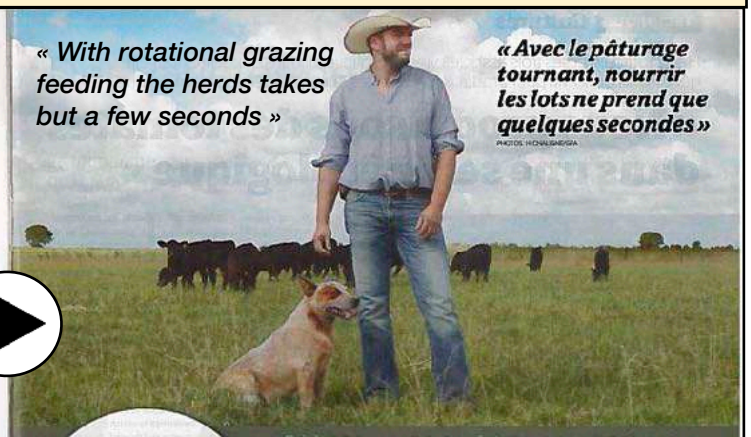
Cette réorientation vers l'élevage et un système extensif a considérablement réduit les charges de l'exploitation. « J'ai 35 ans, je suis installé depuis dix ans, et d'ici trois ans, la ferme n'aura plus d'emprunts en cours », souffle-t-il.

Hélène Chaligne

GÉRER LE PÂTURAGE AVEC UN LOGICIEL

Pour l'aider dans son plan de gestion du pâturage, Jean-Baptiste Drouin travaille avec un logiciel. « La méthode est répandue en Nouvelle-Zélande, où les éleveurs gèrent des centaines d'animaux sur des milliers d'hectares, et ne peuvent pas, par conséquent, se souvenir de l'état de chaque parcelle. Le logiciel retrace tout l'assolement. De mon côté, je rentre régulièrement les mesures de pousse de l'herbe, pour savoir où j'en suis et être au fait de chaque parcelle prête à recevoir un lot. C'est d'autant plus important en pâturage tournant. »

- **Alimentation simple**
- **Autonomie alimentaire**
- **Maîtrise des prix de vente**
- **Travail autour des clôtures**
- **Surveillance rigoureuse de la pousse de l'herbe**

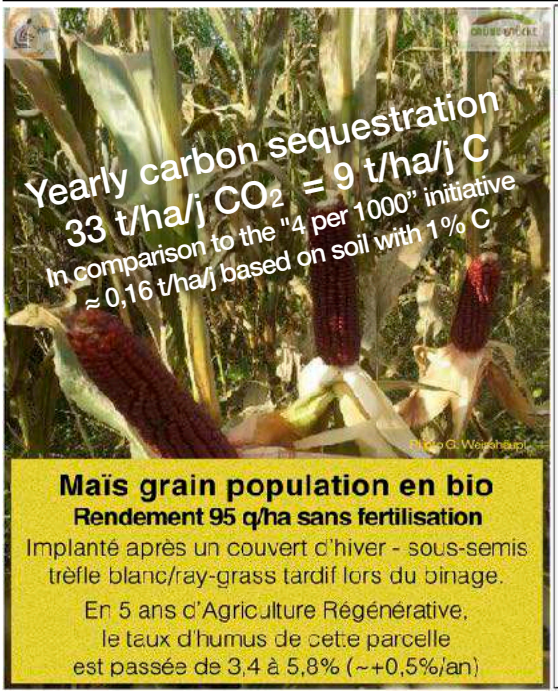


Origine : le troupeau allaitant vient d'Écosse. En France, il n'existe pas de Herd-book dédié à l'angus.

Lots : Les animaux sont allotés par sexe, au sevrage. Les mâles sont conservés pour la vente directe, et les génisses sont vendues comme reproductrices.

Austrian CO_2 program - the Kaindorf initiative

In 2005 the Oekoregion Kaindorf, an Austrian association pursuing environmental and socio-economical goals, set up a CO_2 Program to reward farmers for their eco-systemic services. Organized on a private and voluntary basis the project is funded by companies concerned with their environmental impact seeking to offset the CO_2 emissions associated with their activities by purchasing CO_2 certificates from farmers. By participating in the program, farmers receive a payment of 30€ per ton of CO_2 sequestered in their soil over an agreed-on period.



Carbon Sequestration through Regenerative Agriculture

Gerhard Weisshäupl, an Austrian farmer who has been practicing Regenerative Agriculture for six years (GW in the photo), has increased humus levels by more than 0.5 points per year on his this plot enrolled in the Ökoregion Kaindorf carbon sequestration program (https://www.oekoregion-kaindorf.at/index.php?id=167).

(soil analysis based on GPS/RTK controlled sampling to a depth of 25 cm)

• Humus content in 2013	2.8%
• Humus content in 2017	5.4%
• Increase in humus content	2.6%
• CO_2 sequestration in 5 years	166 t
• Carbon sequestration in 5 years.	46 t
• Cash payment per tonne CO2.	30€
• Yearly cash payment approx.	1,000 €/ha

Companies concerned with their environmental impact finance the program by purchasing CO_2 certificates from farmers to compensate for the carbon emissions related to their business.

Farmers sequester carbon in their soil and receive a corresponding cash payments for this environmental service

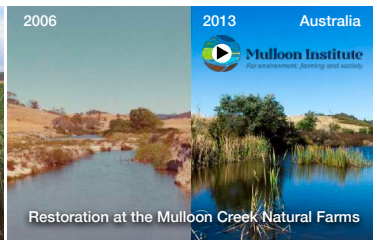
Management practices:
organic farming, minimum tillage, no-till, direct seeding, under-seeding, companion crops, agroforestry, compost, charcoal, diversified cover crops, "double cover crops", use of lactic acid inoculation, compost tea, etc.

There are Thousands of Successful Regeneration Projects all around the Planet, but We Need Millions of them to Tackle Climate Change, Food and Water Security, Poverty, Social Unrest, Migration, ….

In 40 years Jadav Payeng, aka "Forest Man of India », has single-handedly transformed 550 hectares of desert land into a forest that brought back a vast flora and fauna (birds, elephants {115 on the 550 ha}, tigers, rhinos, deer, etc.)!

Pakistan: Planting one billion trees to regenerate a 3,500 km² area in 5 years! Has now been extended to 2028 and 10 billion trees.

Photo sequence showing mangrove restoration at Palk Bay, India. (OMCAR Foundation)



Crucial sources of soil fertility, water and food security, these low-tech climate solutions allow for an immediate start of thousands of decentralized and autonomous greening projects all around the Globe.

- Simple and transparent organizational structures
- Produce fast and easily measurable results
- Low on capital
- Low-tech, low-input and low-energy
- High on environmental and climate benefits
- High on economic and social benefits
- High on people and community building

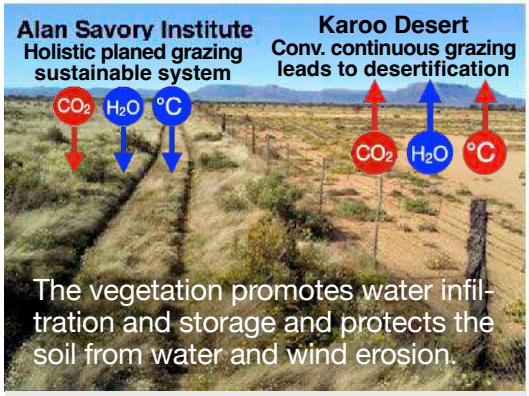
There is no Planet B, but there are lots of Plants to Cool it!

Partnering with Nature or taking the risky high-tech route: that is the question.

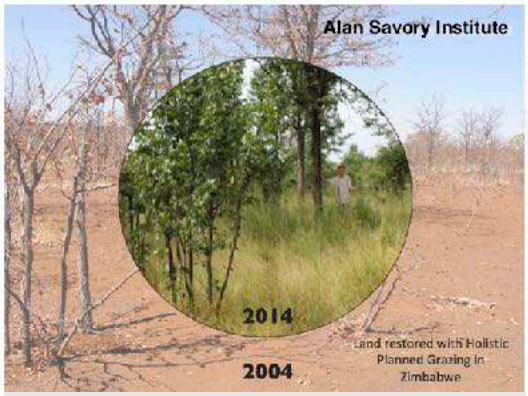
Partnering with Nature to re-green the planet:

based on the restoration of water and rain cycles, these low-tech systems require little energy, resources and investment. They are effective and pay for themselves after only a few years. Producing important benefits in terms of soil and landscape regeneration, food and water security, job creation and socio-economic development of many poor and arid regions of the South.

- Energy efficient
- Resource efficient
- Proven and safe practices
- Modest investments
- Fast payback (5 to 20 years)
- Quick results (3 to 7 years)
- Favorable socio-economic, ecological and carbon footprint



South Africa Holistic management on the left has brought back biodiversity and natural fertility by regenerating the soil, greening the desert, restoring water cycles and cooling the climate.



Zimbawe : Thanks to regenerative grazing, the vegetation comes back to life, the climate becomes more balanced and some creeks start flowing again.

Pakistan: Planting one billion trees to regenerate a 3,500 km² area in 5 years! Has now been extended to 2028 and 10 billion trees.

The High-Tech Route

- CCS technologies
- Solar geoengineering
- Food engineering

- Experimental
- Full of technical unknowns
- Highly energy, resource and capital intensive
- Expensive
- Timing: ????
- Financial sinkhole
- Uncertain results

St Fergus in Scotland could be one of several hubs for industry to capture their carbon emissions and send them underground